NJTRANSIT
The Way To Go.

ALP- 46 LOCOMOTIVES

(4600 - 4628)

Operating Instruction Manual

Edition C 2003 September 15

BOMBARDIER
TRANSPORTATION

BOMBARDIER

Edition C 2003 September 15.

Page	Edition	Comment
all pages	Edition A	Issue 01/12/19
all pages	Edition B	Issue 02/08/05
all pages	Edition C	Issue 03/09/15

A General Part

EDITION C:2003. SEP. 15

B Operating Elements and Modes

EDITION C:2003. SEP. 15

C Operation

Revisions are indicated by marginal bars.

EDITION C:2003. SEP. 15

A General Part

1 Important Information

The work described in this manual must only be carried out by suitably trained specialists. It is essential to use all of the safety devices and to take all of the safety precautions which are required by the applicable safety guidelines and regulations and correspond to the latest technical standards.

Work on the vehicle must only be carried out by specialists who have been specifically trained for this type of locomotive.

Some of the safety information in this manual describes work which is carried out by maintenance personnel, and has been included for the sake of completeness. Although it is described in this manual, this does not mean that such work can be carried out by the driving engineer.

Above all, the driving engineer must not open the high voltage equipment cabinets.

In particular, it is not permitted for the driving engineer to open the HVC, the ICF or CON1 and 2 cubicles.

1.1 Warning and safety symbols

The following symbols are used to indicate precautions which are relevant for safety and points which require special attention:

High Voltage! Mortal Danger!

This symbol warns you about the imminent risk of serious injury or death as a result of high voltages.

Non-observance could lead to serious or fatal injury.

Mortal Danger!

This symbol warns you about the imminent risk of serious injury or death.

Non-observance could lead to serious or fatal injury.

Warning!

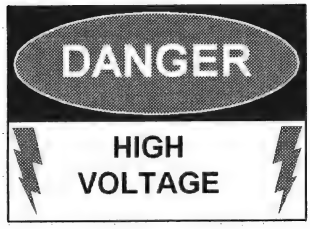
This symbol warns you about the risk of damaging or destroying equipment.

Note!

General instructions
Non-observance could result in damage to components!

EDITION C: 2003. SEP. 15

1.2 Safety signs



1.3 List of abbreviations

Abbreviation	Meaning
ACT	Actuating Pipe
ADU	Speed Display Unit
ASD	Auxiliary Supply & Distribution Cubicle
ASES	Advanced Speed Enforcement System
ASG	Drive Control Unit (= DCU)
ATC/ATP	Automatic Train Control / Automatic Train Protection
AUX	Auxiliary equipment or circuit (e.g. auxiliary transformer)
BC	Brake Cylinder (i.e. brake actuator)
BC1, BC2	Signal Converter (Bus Coupler for the MVB)
BCU	Brake Control Unit
BP	Brake Pipe
C&C	Control & Communication
CAB	Engineer's Cabs F & B
CB	Circuit Breaker
CCU	Car Communication Unit
CCP	Cab Control Portion
CDP	Cab Desk Panel
CDPD	Cellular Digital Packet Data (US wireless data standard)
CFE/ROF	Cab Front End/Roof section

Abbreviation	Meaning
CLT	Cooling Tower
CMP	Compressed Air and Brake Cubicle
COM	Control and Communication Cubicle
COMC	Communication interface for Third party devices
CON 1 & 2	Converter Cubicles
CSS	Cab Signal System (part of ASES)
DCU	Drive Control Unit
DDS	Diagnostic Data Set
DTN	Data Train Network (WTB is part of DTN)
EMC	Electro-Magnetic Compatibility
EP	Electro Pneumatic
EQ'LG	Equalizing (Reservoir)
ER Gauge	Equalizing Reservoir Gauge (EQ'LG)
FER	Fault Event Recorder
FLG	Vehicle Control Unit (= VCU)
FRA	Federal Railway Administration (US railway regulation authority)
FTB	Force Tractive/braking
GPS	Global Positioning System
GW	Gateway
HEP	Head End Power

Abbreviation	Meaning
HSG	Auxiliary control
HV	High voltage (equipment)
HVAC	Heating, Ventilation and Air Conditioning (Unit or System)
HVC	High Voltage Cubicle
HW	Hardware
I/O	Input/Output unit
IARP	Independent Application & Release Pipe
ICF	Interference Current Filter cubicle
IDU	Intelligent Display Unit
IL	Illumination Light
LED	Light Emit Diode
LIM	Line Interference Monitor
LIU	Locomotive Interface Unit
LPB	Locomotive Parking Brake
LVC	Low Voltage Cubicle
MCB	Main Circuit Breaker
MCC	Motor Converter Control
MR	Main Reservoir
MREQ	Main Reservoir Equalizing Pipe
MRM	Machine Room
MSC	Master Sequence Control
MU	Multiple Unit

EDITION C: 2003. SEP. 15

Abbreviation	Meaning
MVB	Multifunction Vehicle Bus
OGF	Optical Glass Fiber
PA	Protective Action
PA/IC	Public Address/InterCom
PB	Push Button
PBI	Illuminated Push Button
PCS	Power Control Switch
PG	Pantograph
POU	Pneumatic Manifold
RDS	Remote Diagnostic System
ROFM	Middle roof section
RRDP	Roof Remote Diagnostic Panel
S	Service Interface (OGF)
SDU	Speed Display Unit
SES	Speed Enforcement System (part of ASES)
SK	Softkey
TCN	Train Communication Network
TCS	Train Control and Safety cubicle
TE/BE	Traction Effort/Braking Effort
TS	Train Supply
VC/PB	Voltage Changeover/Phase Break
VCU	Vehicle Control Unit
VTCU	Vehicle & Train Control Unit

Abbreviation	Meaning
WLAN	Wireless LAN
WTB	Wire Train Bus

EDITION C: 2003. SEP. 15

2 Brief Description of the Locomotive

The ALP-46 series locomotives with serial numbers 4600 through 4628 are microprocessor-controlled locomotives with GTO-based three-phase drive technology.

Each ALP-46 locomotive can operate as a single unit or as a multiple unit consisting of two, three or four locomotives. It can also be operated from a cab car.

2.1 Mechanical components

2.1.1 Car body

The car body of the ALP-46 is constructed of steel and is a self-supporting welded unit. The superstructure mainly consists of the two drivers cabs and the cab side walls. The roof is constructed of three removable aluminum elements.

2.1.2 Trucks

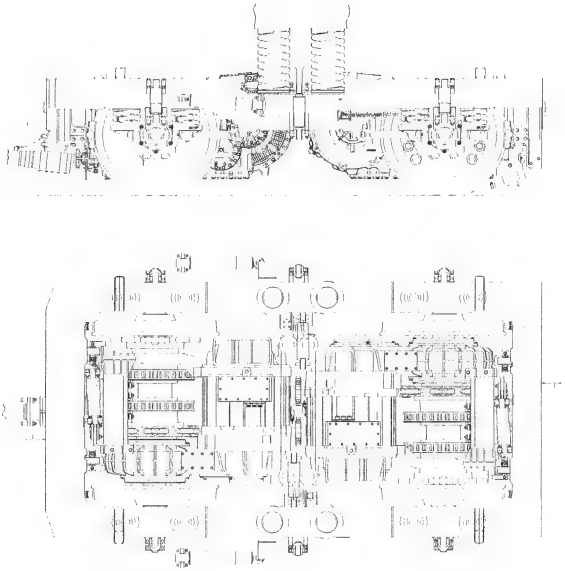


Figure A-1: Truck

The truck frame of the ALP-46 consists of:

- two side sills for mounting the flexicoil springs
- one beam in the middle to support the integrated drive unit (traction motor)
- two beams at the ends (one of them carries the linkage for the traction rod)

Truck suspension and damping

The primary suspension consists of two pairs of parallel coil springs which are supported by the wheelset bearing housings.

The secondary suspension consists of two flexicoil springs above the truck which are supported by the side sills of the truck frame.

In addition to vertical hydraulic dampers in the

primary and secondary suspension, each truck is provided with two secondary horizontal shock absorbers and two longitudinal shock absorbers. The arrangement of the longitudinal shock absorbers has been chosen to ensure low mechanical stresses and high riding quality.

Transfer of traction forces

Each truck is provided with an inclined traction rod (see Figure A-2) to transfer traction and braking forces between the truck frame and the car body. This arrangement results in lower axle loading in the truck compared to a design using pivots.

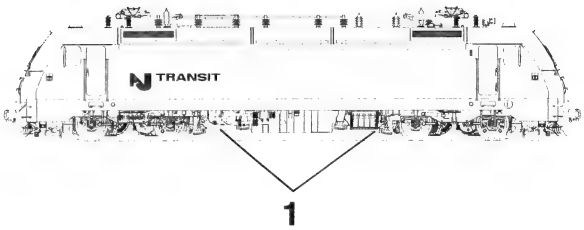


Figure A-2: Transfer of traction forces

#	Description
1	Traction rods

Wheel sets

Each wheel set consists of monoblock wheels, two brake discs and the hollow shaft, which is directly attached to the integrated drive unit. The wheel set bearings consist of low maintenance compact cylindrical roller bearings.

Integrated drive unit

The traction motors are assembled together with the gear chain, disc brakes and hollow shaft to form the integrated drive unit . The integrated drive unit is attached on one side to the truck frame and on the other side through a mounting bar to the car body.

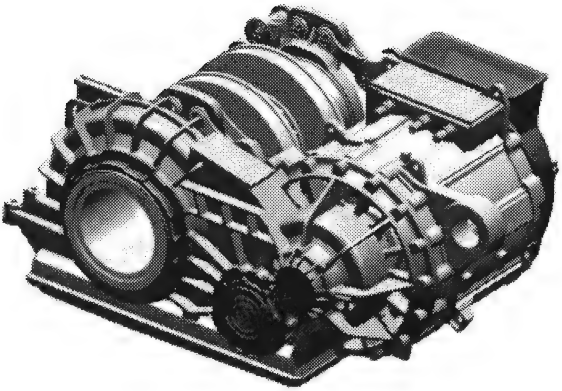


Figure A-3: Integrated drive unit

2.1.3 TE/BE diagram

The following diagram shows the traction effort and the dynamic braking effort limitation of the locomotive in relation to the locomotive speed.

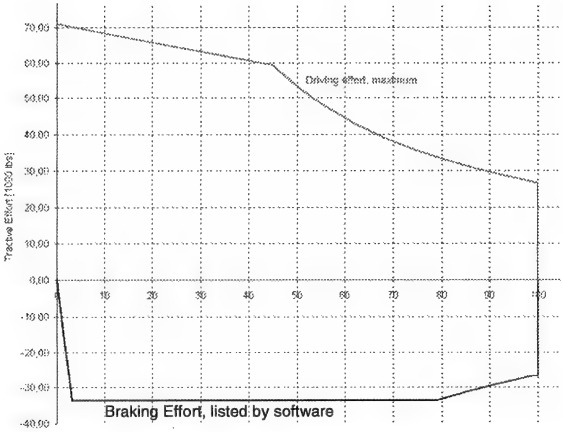


Figure A-4: Traction Effort/Braking Effort versus speed

2.2 Compressed air and braking equipment

2.2.1 Air compressor

The locomotive is supplied with compressed air by a screw type compressor driven by a three-phase motor. The compressor is switched on/off automatically (124,8 - 140,7 psi / 8.6 - 9.7 bar) by the locomotive control unit. Starting of the compressor does not require the system to be pressurized.

The compressed air passes to the two 63 gal main air reservoirs through a check valve and a safety valve. It then passes through the air drying system to several consumers and to an additional check valve before reaching two further 63 galmain air reservoirs.

Condensate draining for main air reservoirs 1 and 2 is automatic. Condensate draining for main air reservoirs 3 and 4 is manual.

EDITION C: 2003. SEP. 15

2.2.2 Braking equipment

Brake control is handled by a WABTEC EPIC II braking system. The system consists of the equipment on the engineer's desk and the control electronics with the associated processors and includes all of the pneumatic equipment related to the brakes.

The EPIC II system is responsible for brake pipe control, brake pipe monitoring, brake cylinder control and monitoring.

The EPIC II system consists of

- A brake handle unit in each engineer's cab (cab control portion CCP)
- One cab control car communication unit (CCU)
- One brake control unit (BCU)
- One locomotive interface unit (LIU)
- One pneumatic manifold (POU)

The brake control equipment is not redundant.

The brakes consist of a pair of brake discs on the hollow shaft of each axle.

The brakes are operated either by the automatic brake as a result of pressure drop in the brake pipe or by the direct brake of the locomotive.

Communication between the WABTEC system and the Vehicle Control Unit, which is based on MITRAC equipment, is done by both digital and analog output signals to the WABTEC LIU (locomotive interface unit) and by a serial link between the WABTEC processor and the MITRAC VCU.

The hand brake which is used to secure the non operated vehicle consists of a mechanical brake which is applied and released electrically.

2.3 Electrical components

2.3.1 Main circuit diagram

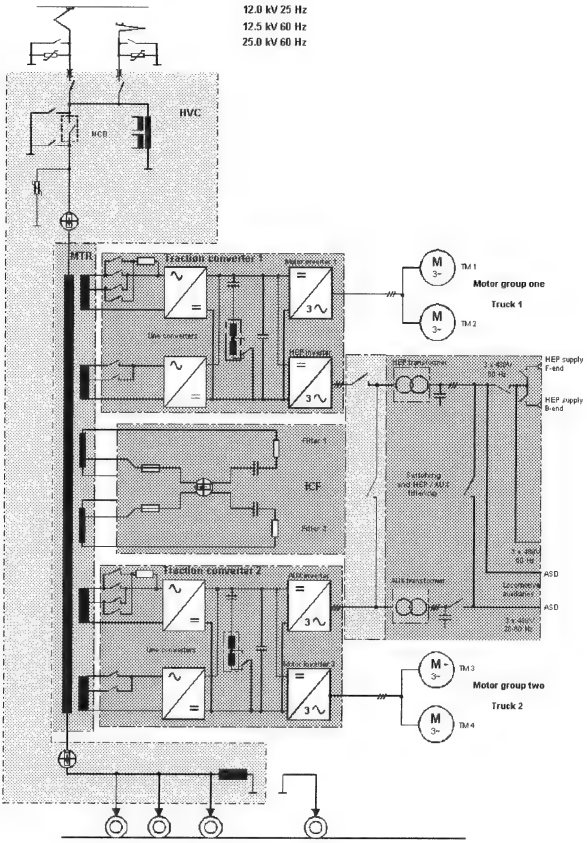


Figure A-5: Main circuit diagram

The ALP-46 is supplied with electrical energy via two TransTech high speed pantographs. Each pantograph is protected by a surge arrestor.

The current passes through roof mounted lines to bushings above the High Voltage Cubicle (HVC). Each supply line has its own pantograph disconnecting switch and the two HV lines are

connected together at the Main Circuit Breaker (MCB).

The MCB is connected to the primary winding of the main transformer by an HV cable which runs from the HVC down to the transformer tank. The HV cable is connected to a third surge arrestor which protects the input side of the transformer.

The pantographs and the MCB are similar to that of the ALP-44 and are operated by compressed air. To operate the MCB, the vehicle control electronics activates a compressed air solenoid valve which is mounted next to the MCB.

Each of the two traction converters are fed by two traction windings. The filter windings are for damping pulsations and transient distortion.

The two traction motors on each truck are connected together to form a motor group. Each motor group has its own traction converter which allows it to be controlled separately. The motor groups are fed with 3 phase current with variable voltage and frequency.

The following main HV components are installed inside the HVC:

- The MCB,
- The grounding switch,
- The third surge arrestor,
- The primary voltage transducer,
- The second step of primary voltage monitoring,
- The primary current transducer,
- The return current transducer,
- The ground protection choke,
- Both pantograph disconnecting switches.

2.3.2 Three-phase drive technology

The locomotive works with either 12.0 kV/25 Hz, 12.5 kV/60 Hz or 25.0 kV/60 Hz (single phase) from the overhead catenary system. The traction converters convert this to three-phase current with variable frequency and voltage which is used to power the three-phase traction motors.

The advantages of three-phase drive technology are as follows:

- Smaller physical size and reduced weight for the same power
- Low wear (no commutator, no carbon brushes)
- The locomotive can be used for a wide range of applications since it can provide a high tractive force over the entire speed range
- Favorable starting characteristics even with gradients since maximum torque is possible even when the motor has just started
- Regenerative power can be fed back to the overhead catenary system

The rotary speed of the traction motors is proportional to the variable frequency of the three-phase supply from the traction converters. The voltage is adjusted proportionally to the frequency to ensure maximum flux in the motor at all times. The required motor torque is controlled via the difference of real to set speed.

EDITION C: 2003. SEP. 15

2.3.3 Transformer and traction converters

Main transformer

The transformer tank is located underneath the car body between the two trucks. The tank contains the main transformer, both second harmonic inductor pairs, the HEP and the AUX transformers.

The HV connector to the main transformer which is an elbow plug on the right side is connected to the HV cable coming from the HVC.

Depending on the conditions of the line supply, the traction requirements and the train supply requirements, the vehicle control electronics derates the traction power to avoid overloading the line converters of the traction converters.

The traction converters are connected through a switching matrix to different taps of the traction windings to provide best performance under all three line systems. This is done on the secondary side of the main transformer. There is no switch for system select on the primary side.

All ratings are valid for the nominal voltage. The transformers sensors are monitored by the vehicle control electronics.

Technical data of transformer

Primary power (kVA)	7000
Primary voltage (kV)	12/12.5/25
Frequency (Hz)	25 / 60
Power traction windings (kVA)	4 x 1500
Power filter windings (kVA)	2x250 / 2x500
Weight (t)	13.5

The transformer cooling medium is ester (MIDEL 7131), which can extract more heat losses out of the transformer than mineral oil. Ester has a much higher ignition temperature than mineral oil and is much more environmentally friendly than mineral or silicon oil.

Traction converters

The traction converters consist of:

- two out of phase four quadrant choppers; each four quadrant chopper is connected to a separate transformer winding and feeds the intermediate DC link;
- the motor inverter, which converts the DC voltage into three-phase current with variable voltage and frequency which is used to feed the two traction motors on each of the trucks.

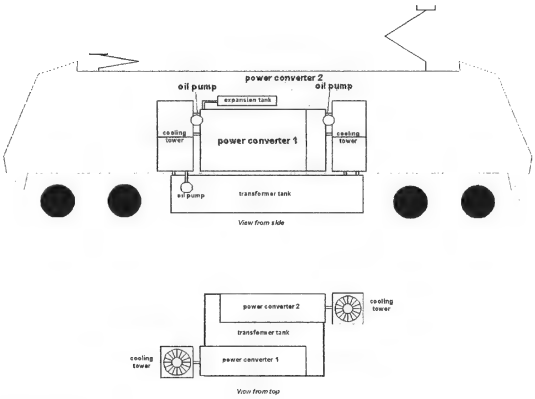


Figure A-6: Traction converters

During braking, the traction motors feed the regenerative braking power back to the overhead catenary system via the motor inverter, the intermediate DC link, the four quadrant chopper and the transformer.

If the temperature of the transformer, the traction converter or the traction motors increases above the first warning level, the traction power is continuously reduced from 100% to 0%. If the increase exceeds the second warning level, the traction power interlock will be triggered.

Within the permitted range of dynamic braking, the braking energy is used by the HEP and the AUX systems to reduce power consumption.

2.3.4 Cooling system for transformer and traction converters

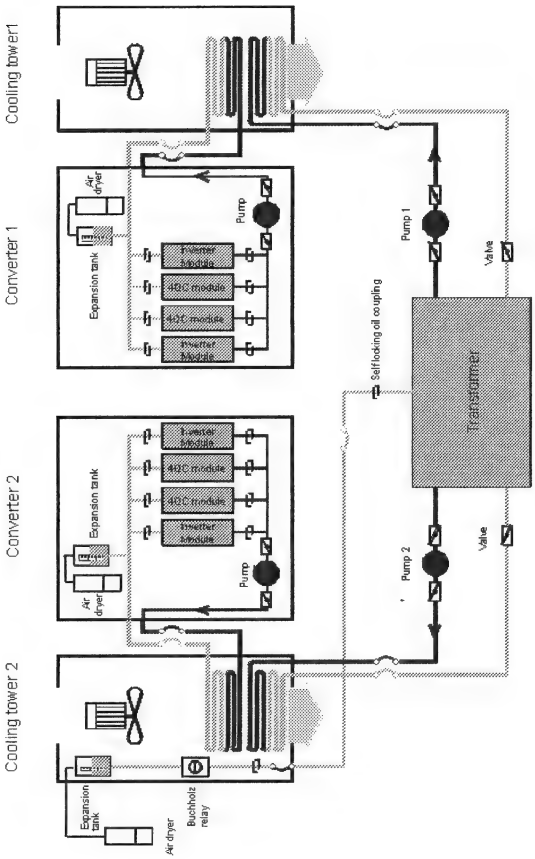


Figure A-7: Coolant circulation

Coolant circulation

The transformer is cooled by two independent cooling circulations; the two traction converters each have one coolant circulation.

Coolant

The liquid coolant for the traction converters and transformer is an environmentally friendly and flame resistant polyester.

Coolant pumps

A separate coolant circulation pump is provided for each of the cooling circuits. The pumps for the two traction converter cooling circuits are installed in the traction converter cabinets. The two coolant pumps for the transformer are mounted on the outside of the transformer.

Cooling tower fan

Heat is removed by two pairs of heat exchangers which are installed one above the other in each of the two cooling towers (see Figure A-7). Each of the cooling towers contains a radial fan which sucks in cooling air from the outside via apertures in the sloping part of the roof. Cooling air is forced through the heat exchangers and fed to the outside again below the car body. Special sound absorbers are installed in the air intake apertures to reduce noise.

Expansion chambers

The cooling circuit for each of the traction converters is provided with an expansion chamber with an inspection window which is visible from the corridor through the machine room. The transformer also has an expansion chamber with an inspection window which is located on cooling tower 2 and visible from the machine room.

Buchholz protector

The transformer is monitored by a Buchholz protector mounted on cooling tower 2, which checks for gas formation as a result of flashover.

If the Buchholz protector outputs a "warning" signal, this results in an alarm on the diagnosis unit and a message with remedial measures is shown on the display.

If the Buchholz protector outputs an "alarm" signal, the main circuit breaker is also tripped and disabled.

2.3.5 Battery system

Locomotive lighting and low voltage control systems operate on 74 V DC. This system mainly consists of the battery charger (BAC), the battery box (BAT) and the 74 V power distribution (Low Voltage Cubicle, LVC).

The battery charging system provides power to all DC loads operating at 74 VDC as well as for charging the battery in parallel. Examples of DC loads are the lighting systems, the line radio, the ATC and the whole control electronics.

The battery voltage is monitored by the diagnostic system.

The loads are divided in lasting, essential and non-essential loads and are supplied by separate circuits. The load circuits for alerter, ATC, FRA recorder, battery charger, 74V/24V DC/DC converter, marker lights and radio all are essential load circuits. The various loads in the different assemblies are protected individually by line circuit breakers located in the LVC.

All circuit breakers and contactors are monitored by the vehicle control via I/O interfaces (MITRAC modules) which are also located in the LVC. The most important line circuit breakers are equipped with color markers. Red is for lasting load circuits, blue is for essential load circuits.

Battery contactor switch and battery protection:

The Battery Contactor Switch {125} is installed in the rear wall cabinet of the Cab F. The switch has two positions:

- Battery on (1)
- Battery off (0).

Even when the Battery Contactor Switch is in the OFF position, the battery protection, the EPIC brake controller, the boarding lights and the lights inside the locomotive can still be used for practical reasons. These are the 'lasting loads'. The essential loads remain connected to battery for half an hour after opening the Main Battery Contactor {126.4}. This is controlled by a time relay {126.52}. All the other systems are cut off. This ensures that battery power consumption is minimized and the battery is not discharged when the locomotive is not in service. Of course the boarding lights, the MRM and the cab lights also can be switched off individually.

In addition, the cab lights and the machine room lights are timer controlled when the Battery Contactor Switch is turned off. The timer is set to 30 minutes.

The marker lights must be switched off manually to prevent unintentional discharging of the battery.

A digital battery charging ammeter and a voltmeter are installed in the ASD.

The battery protector system prevents complete discharge of the battery by opening the main battery contactor. It switches off the main power loads such as Vehicle Control Units (VCU), Drive Control Units (DCU) and several installations in the cab.

The Main Battery Contactor {126.4} is switched off by the software running on the Vehicle Control Unit (VCU) after a delay of 60 minutes from the time the battery charger becomes inoperative.

15 minutes prior to disconnecting the battery, a continuous non-resettable, software-controlled audible alarm is output. The Main Battery Contactor can be switched on again for an additional 60 minutes by reclosing the Battery Contactor Switch.

If the battery voltage drops below 55 volts (under certain circumstances 57 V), the batteries are immediately disconnected from the main power consumers.

Note!

Note: The main Battery Disconnecting Switch {113} is located inside the LVC.

2.3.6 Pantograph control

The pantographs are in the down position by default. The preliminary selection, done with the pantograph selection switch {129.2}, allows the engineer to choose in advance whether to raise pantograph F or pantograph B or both pantographs. The engineer then pushes the toggle switch PANTOGRAPH {129} to "PAN UP" (non-latching) to raise the selected pantograph(s). Raising is then done by the pantograph air valve if sufficient air pressure is available.
The engineer pushes the toggle switch PANTOGRAPH {129} to "DOWN" (latching) to lower the pantograph(s). The pantographs are only lowered after the MCB has opened.

The position of the pantograph selection switch can be changed at any time. If both pantographs are lowered, the pantograph configuration becomes active after raising the pantograph(s) if the pantograph grounding switches and disconnector switches are also in the correct position. The procedure to change the raised pantograph is subdivided into following steps:

- One pantograph is already raised (and the MCB is closed)
- The engineer selects the other pantograph as the active pantograph
- The other pantograph will raise (if the pantograph grounding switch and disconnector switch are also in the correct position), regardless of vehicle speed
- the first pantograph is lowered 10 seconds after raising the other pantograph

If the position of a pantograph is not correct (for example pantograph F should raise but after some time no line voltage is detected), the software signals a fault and the engineer is alerted by the fault lamp/alarm bell and by a message on the IDU.

If one pantograph is isolated and used for ice

scratching, the pantographs are not lowered at a phase break.

Warning!

If both pantographs are raised with both isolation switches closed while entering a phase break, both pantographs are lowered for safety reasons.

The pantograph air valve is not energized and the pantographs are not raised if the locomotive is in simulation mode. In addition, the air for the pantograph valve is not available because the appropriate key was removed to enable the simulation. The software simulates the raising of the pantographs and the presence of the line voltage.

2.3.7 Main circuit breaker control

Operation

The main circuit breaker (MCB) with the attached grounding switch is a vacuum type circuit breaker with a stored energy spring mechanism. It is preloaded with compressed air and the switching on and switching off actions are powered by the springs.

HVC grounding switch

You must not operate the grounding switch until both pantographs are lowered. The HVC grounding switch is unlocked by the red key which can only be released from key multiplier 1 on the CMP when the blue key is inserted. On removing the blue key from the pantograph air valve, the pantograph pressure is released and the pantographs are lowered.

Grounding the locomotive

See "Grounding the locomotive" on page 52 for information on grounding of the locomotive and the associated safety key concept.

2.3.8 Auxiliary supply circuits

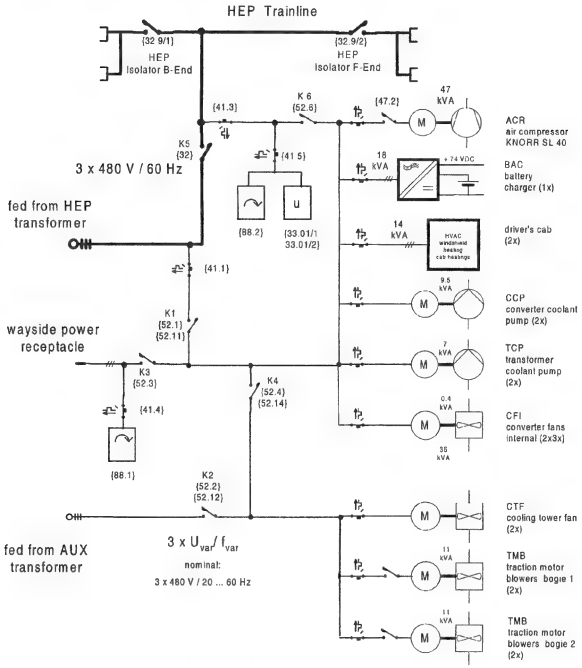


Figure A-8: 480 V AC supply

The ASD is fed from four sources and divides the 480 V three-phase power distribution for all auxiliary systems into two groups. The power supplied from the (1) HEP and (2) AUX transformer, (3) HEP trainline or (4) wayside power receptacle is distributed to fixed and variable frequency loads by means of interlocked switch-over contactors {52.1} {52.2} {52.3} {52.4} {52.6}.

Components normally supplied by the variable frequency AUX transformer output are:

- Cooling tower fans for transformer and converters {57}{58}
- Traction motor blowers {53}

Components normally supplied by the fixed frequency HEP transformer output are:

- Battery charger {107}
- HVAC unit engineer´s cab {860}
- Additional Cab heater in cab rear wall {69}
- Windshield heating {69.31}{69.32}
- Converter coolant pumps {63.1}
- Transformer coolant pumps {62.1}
- Air compressor {47}
- Internal Converter fans {12.Mo1 ... Mo3}

The Wayside Power Receptacle {42.1} is provided to keep the battery charged while maintenance work or inspections are in progress, for operating the air conditioning while the locomotive is being prepared for service independently of high voltage supplies or for other purposes such as testing of pumps and fans during maintenance in the shop.

In case of a 'dead' loco, contactor {52.6} allows you to supply mainly the battery charger and air conditioning unit from the shop or another loco backwards via the HEP trainline.

The HEP trainline is supplied with power and can be isolated from the HEP transformer via the HEP main contactor {32} and the HEP Isolators {32.9}.

It is possible to select only one locomotive end to be supplied with 480 volts HEP using a configuration with only one of the HEP Isolators {32.9}.

2.4 Overview of control electronics

The Control and Communication system structure is based on the MITRAC system, a computerized, distributed system which is optimized for use on electric traction vehicles. Communication is done according to the internationally standardized train communication network (TCN) and consists of the MVB (Multifunction Vehicle Bus) and WTB (Wire Train Bus).

The redundant Vehicle and Train Control Units (VTCUs) are located within the COM cubicle in the machine room. Each cubicle in the machine room and the main locations in the cabs contain I/O modules for interfacing to the associated hardware devices (switches, lights, etc.).

Communication between the COM cubicle and the other locations is mainly done via fiber optic MVB connections (OGF). The fiber optic bus is converted into a local electrical bus within each location/cubicle.

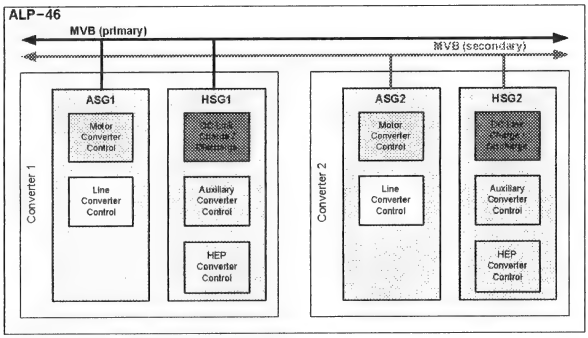
Vehicle & train control unit

The vehicle control system is designed as a redundant system. The VTCUs (containing 2 or 3 VCU boards) supervise each other. If one unit fails, the functionality is still available on the other one.

EDITION C: 2003. SEP. 15

Converter control unit

Each Converter Control Unit consists of an ASG and a HSG device. The following schematic diagram illustrates the interconnection of the functional blocks:.



ASG 1/2 (Antriebs Steuer Gerät) = Drive Control Unit 1/2
HSG 1/2 (Hilfsbetriebe Steuer Gerät) = Auxiliary/Head End Power Control Unit 1/2

Figure A-9: CCU showing ASG and HSG

Intelligent display unit (IDU)

The ALP-46 locomotive is equipped with one IDU in each cab. The purpose of the IDU is to provide the engineer with the necessary information about the status of the locomotive. See "Intelligent display unit (IDU)" on page 61 for more information.

Multifunction vehicle bus

The MVB is organized in 3 physical segments: the primary segment, the secondary segment and the tertiary segment.

Redundant devices are located once on the primary and once on the secondary segment, so that if one segment fails the functionality is still available on the other segment.

The tertiary segment physically connects the primary and the secondary segment. If either fails, the tertiary segment will remain available.

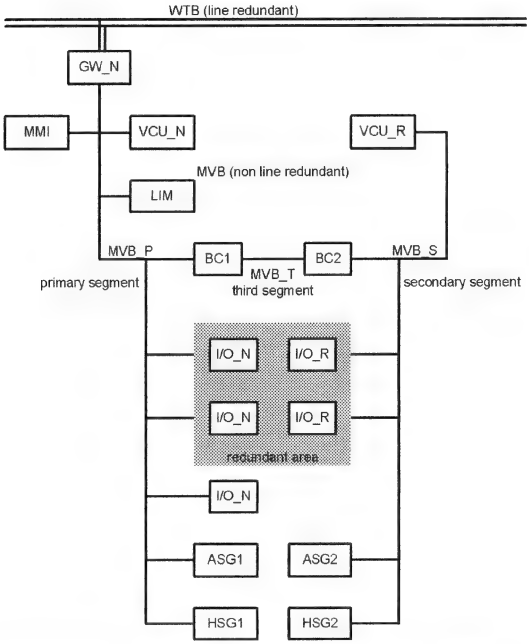


Figure A-10: Multifunction vehicle bus (MVB)

The primary segment consists of almost all Vehicle Control components necessary for the full functionality of the locomotive.

The secondary segment consists of additional redundant Vehicle Control components necessary for vital functions of the vehicle and duplicate components such as Converter Control.

Bus couplers

The bus coupler BC1 and BC2 interconnect the primary and secondary bus segments and at the same time provide isolation between the bus segments to limit network-wide effects of a failed bus segment. The third bus segment remains operational if either BC1 or BC2 fails.

2.5 ATC / ASES

The ATC main unit is located in the COM cubicle. The service connections and cut-out switches are located on the front panel of the ATC.

The main function of the automatic train control (ATC) on the locomotive ALP-46 for NJTransit is to pick up train stop signals and the maximum speed allowance from railway side transmission system(s), to display the received information to the engineer and to enforce maximum speed limits and to apply penalty stops if required.

The Advanced Speed Enforcement System (ASES) consists of two main subsystems:

- SES Speed Enforcement System
  SES has access to the service brake where it can demand a penalty brake. SES is equipped with decelerometer and discrete I/O channels for pneumatic signals to survey train reaction. It transfers train speed information collected from an axle tachometer to the speed display unit (SDU) on the engineer's desk.
- CSS Cab Signal System
  CSS provides halt signalling and overspeed detection. It also transfers block information to the speed display unit (SDU) on the engineer's desk and processes engineer acknowledgement.

Both ASES sub-systems get their wayside signals through antennas mounted below the vehicle in front of the leading axle. SES and CSS are separated, physically independent computer-based electronic devices. They are both mounted in the same housing and have their own power supply.

2.6 Cleaning brake

The task of the cleaning brake is to improve the adhesion by cleaning the wheels. The cleaning blocks for all wheels are controlled together and are automatically activated upon request from the wheel slip control system within the ASG.

2.7 Wheel slip control system

The wheel slip control system prevents the wheels from slipping during acceleration of the locomotive by automatically reducing the tractive effort.

2.8 Slide protection

EPIC II system offers a binary input to command the release of the locomotive brake for up to 5 seconds. If the Vehicle Control detects a slide, brake cylinder pressure is dumped to protect against flat spots. The demand to reduce brake cylinder pressure originates from either traction control ASG1 and ASG2 or the VCU.

2.9 Multiple unit operation

The locomotive control system allows the locomotive to operate as a single unit or as a multiple unit with up to three other locomotives. It can also be remote controlled from a cab car in a train.

Communication with other locomotives and/or the cab control car is provided via the 27 poles trainlines or the WTB.

2.10 Automatic Sanding

Automatic sanding is activated by the wheel slip control system within the ASG when wheel slipping exceeds a certain limit during acceleration.

EDITION C: 2003. SEP. 15

2.11 General specifications

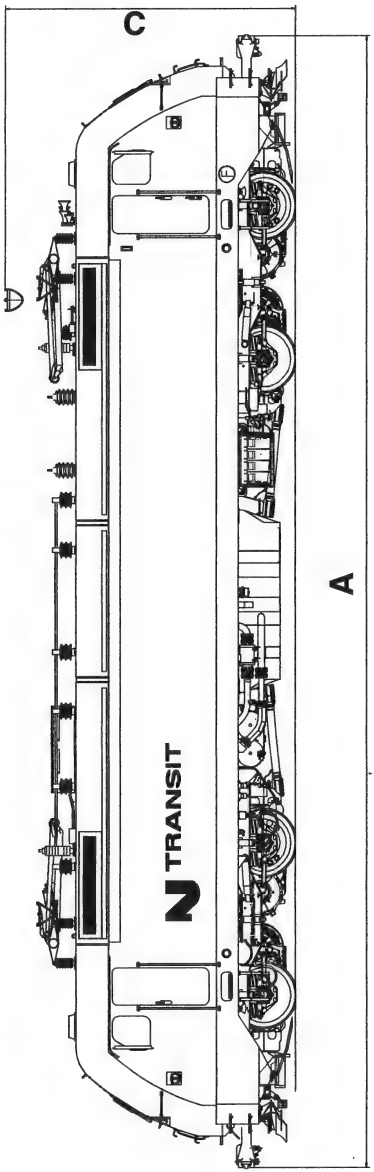


Figure A-11: Dimensions

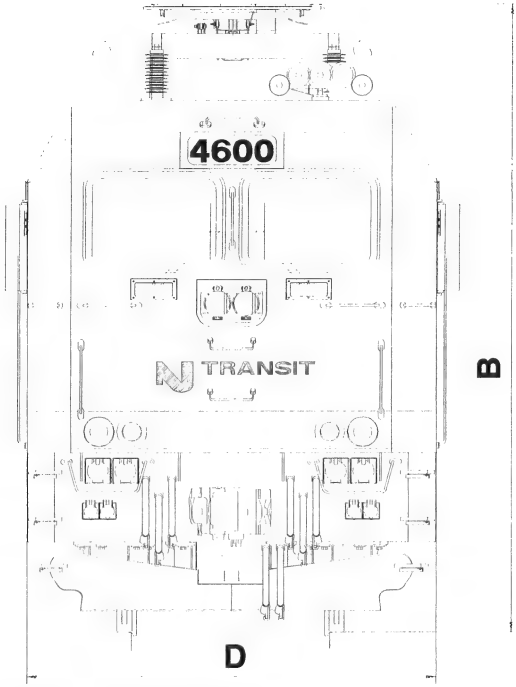


Figure A-12: Dimensions

Locomotive:

Model name	ALP-46 (numbers 4600 - 4628)
Axle arrangement	B-B
Track width	4ft 8-1/2 in

Main Dimensions:

A Length over couplers	65 ft.
B Height over Locked Down Pantograph	14 ft. 11-1/2 in.
C Height over Fully Extended Pantograph (Nominal)	19 ft. 10 in.
D Width over body	9 ft. 10 in.
Truck Wheel Base	8 ft. 10 in.
Truck Centers	36 ft. 6 in.
Curve Negotiation	254 ft. radius

EDITION C: 2003. SEP. 15

Weight on Drives:

Maximum	207,000 lbs
Maximum per Axle	51,000 lbs

Driving Wheels (4 Pairs)

Diameter	
new	44 in.
worn	41.2 in.
Maximum Speed	100 mph

High Voltage Supply:

Transformer (Ester oil cooled)	Primary Voltages: 12 kV 25 Hz 12.5 KV 60 Hz 25 kV 60 Hz
Converter	
Periodic turn off current	2.100 A
Max. turn off current	2.600 A
RMS current line Converter	1.350 A

Power for Auxiliary Machines:

Rating	3 Phase, 480 V 20 - 60 Hz, 140 kVA
HEP for Cars Rating	3 Phase, 480 V 60 Hz, 1100 kVA
Pantograph (2)	
Type	TransTech, P/N 29500D

Integrated Drive Unit (4)

Model	Bombardier Transportation
Type	4 FIA 7065 H
Weight	8,800 lbs
Maximum traction effort	17,750 lbs
Current Nominal	350 A
Current Max.	490 A

Air Brakes:

Type	WABCO PBAM254-255

Air Compressor, Knorr Rotary Screw:

Capacity	113 cu. ft./min.

Auxiliary Air Compressor, Knorr Piston

Capacity	2.3 cu. ft./min.

Storage Battery:

Type	EXIDE 4LMS-450
Number of Cells	32
Voltage	64 V DC
Rating (8 hour)	440 Ah (8 hours)

Sand

4 boxes,
each 778 lbs.

EDITION C: 2003. SEP. 15

2.12 Overview of the vehicle

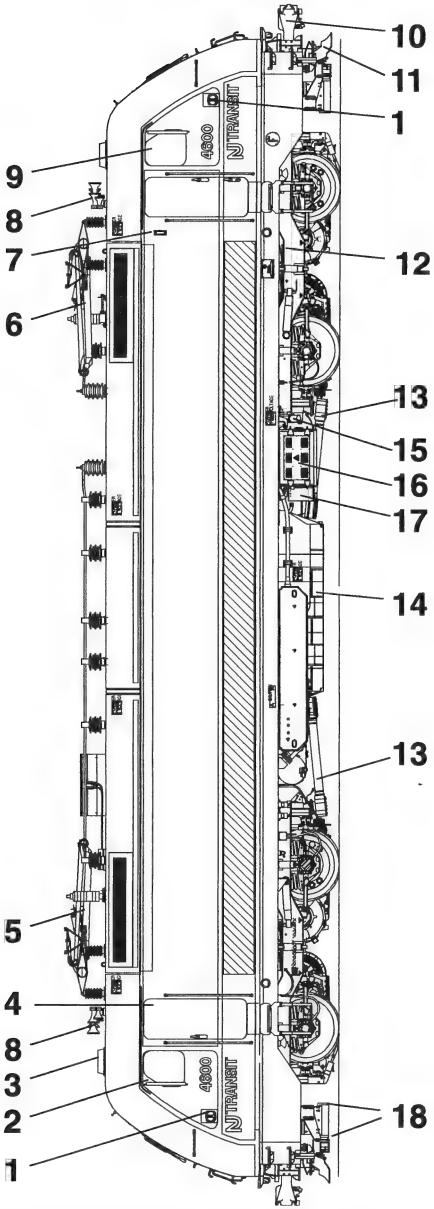
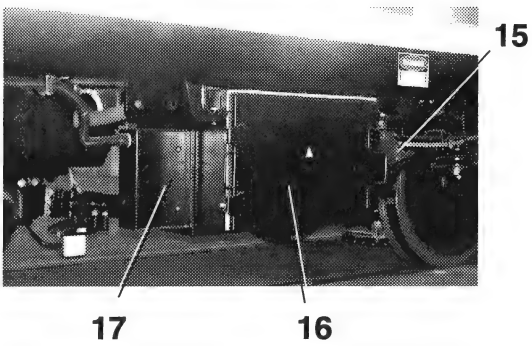


Figure A-13: Overview of the vehicle

#	Description
1	Filling aperture for sand
2	Rear view mirror
3	Antenna for train radio equipment
4	Cab door
5	Pantograph 2
6	Pantograph 1
7	ATC On and Hand Brake Applied indicators
8	Horn
9	Side window
10	Center buffer coupling
11	Snow plough
12	Truck
13	Traction rod
14	Transformer
15	Wayside Power Receptacle
16	Battery Box 1
17	Battery fuses
18	ATC antennas



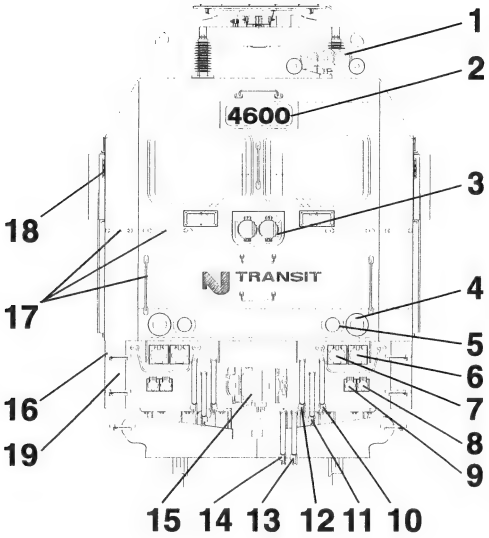


Figure A-14: Front view

EDITION C: 2003. SEP. 15

#	Description
1	Horn
2	Number Light
3	Headlights
4	Marker Lights
5	Ditch/Crossing Lights
6	"Locomotive control" receptacle (trainline)
7	"Communication/Brake/Door" receptacle
8	HEP receptacle
9	HEP receptacle
10	Independent Application & Release (IARP)
11	Actuating Pipe (ACT)
12	Main Reservoir Equalizing Pipe (MR EQ)
13	Main Reservoir Equalizing Pipe (MR EQ)
14	Brake Pipe (BP)
15	Center buffer coupling
16	Boarding Lights
17	Grab Iron
18	ATC On and Hand Brake Applied indicators
19	DTN receptacle

See also "Coupler, cable and hose end connections" on page 172.

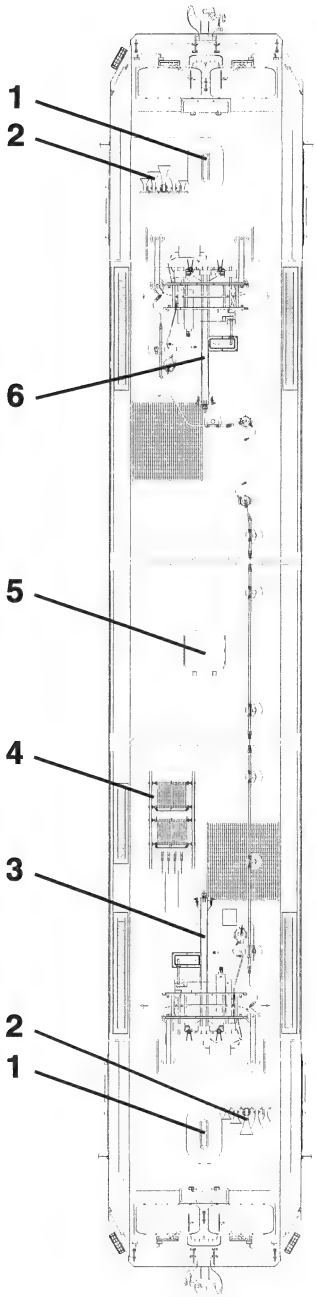


Figure A-15: View from above

#	Description
1	Antenna for train radio equipment
2	Horn
3	Pantograph 2
4	Filter resistor bloc
5	Roof hatch
6	Pantograph 1

2.12.1 Truck

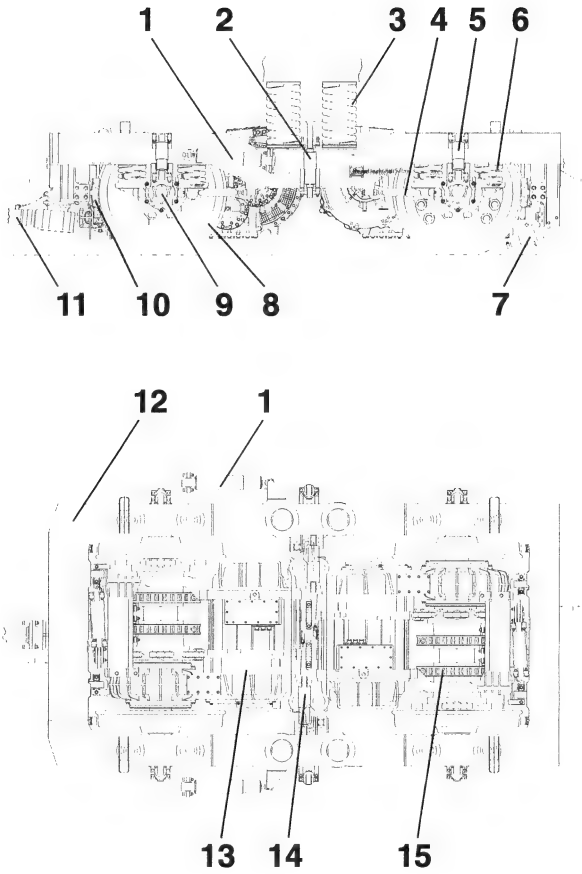


Figure A-16: View of truck

#	Description
1	Longitudinal damper
2	Secondary damper
3	Secondary suspension
4	Wheelset linkage elements
5	Primary damper
6	Primary suspension
7	Sand nozzle
8	Monoblock wheel disc
9	Wheelset bearing
10	Cleaning brake
11	Traction rod
12	Truck frame
13	Integrated drive unit
14	Horizontal damper
15	Brake disc

2.12.2 Machine Room

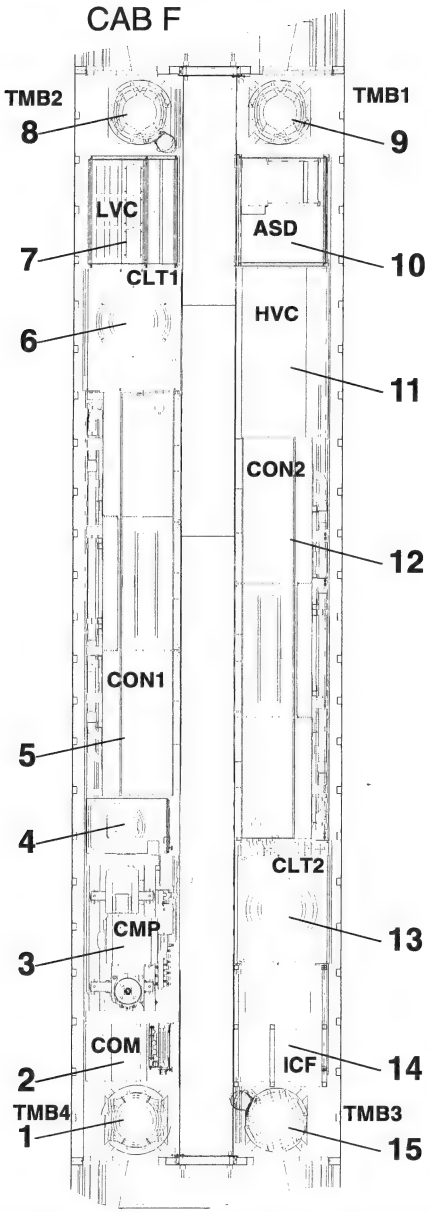


Figure A-17: Main components in the machine room

#	Description
1	Traction Motor Blower 4 (TMB4)
2	Communication Cubicle (COM)
3	Pneumatic Equipment (CMP)
4	Toilet (WC)
5	Converter 1 (CON1)
6	Cooling Tower 1 (CLT1)
7	Low Voltage Cubicle (LVC)
8	Traction Motor Blower 2 (TMB2)
9	Traction Motor Blower 1 (TMB1)
10	Auxiliary Supply & Distribution (ASD)
11	High Voltage Cubicle (HVC)
12	Converter 2 (CON2)
13	Cooling Tower 2 (CLT2)
14	Interference Current Filter (ICF)
15	Traction Motor Blower 3 (TMB3)

3 Safety Devices (High voltage part)

High Voltage! Mortal Danger!

You must not remove any of the safety keys from the locomotive. You must not use safety keys from other locomotives.
Non-observance could endanger the safety concept!

High Voltage! Mortal Danger!

Before energizing the locomotive, the HVC, ICF and traction converter cubicles must be locked and all keys must be inserted in the correct positions in the key multipliers.

High Voltage! Mortal Danger!

You must observe all of the following points before you work on the electrical equipment!

Five safety rules

Carry out the following before working on the electrical equipment:

- Switch off or disable all sources of electrical power.
- Take steps to make sure the power cannot be switched on again.
- Check for the absence of dangerous voltages.
- Ground and short circuit the equipment.
- Cover up or partition off adjacent components which carry dangerous voltages.

EDITION C: 2003. SEP. 15

3.1 Safety key concept

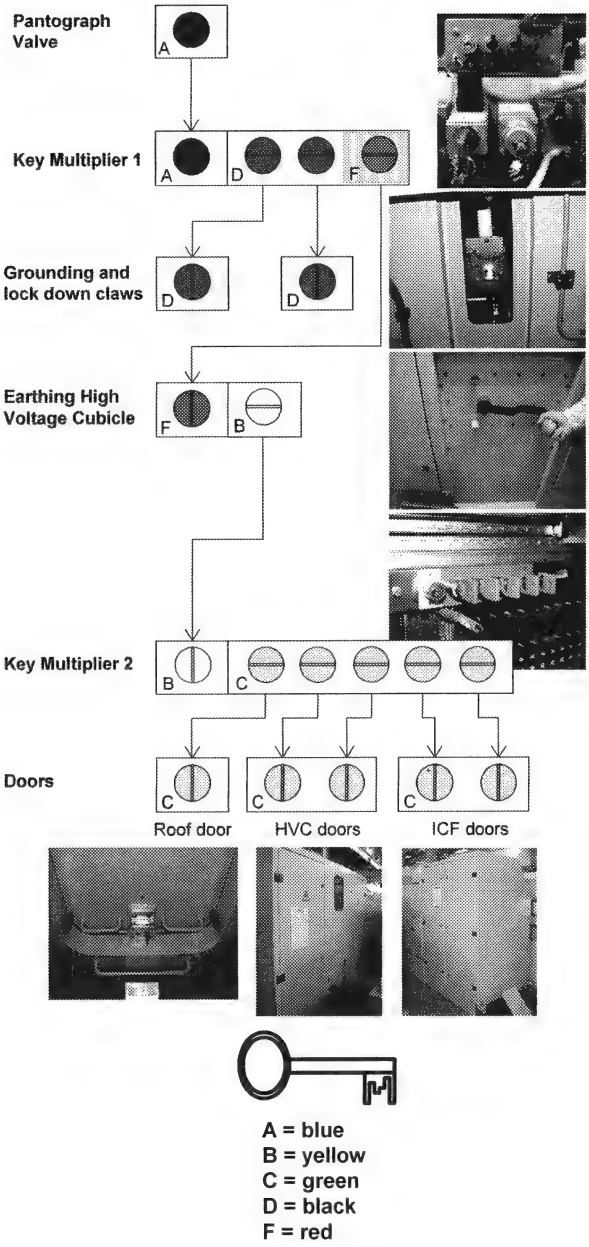


Figure A-18: Safety key concept

3.2 Grounding the locomotive

High Voltage! Mortal Danger!

Before grounding the locomotive, all pantographs must be lowered and the main circuit breaker must be switched off.

Pantograph Valve

Open the pantograph air valve on the CMP to release the blue key. This releases the pantograph pressure and lowers the pantographs.

After the air supply system has vented, check that both pantographs are down. Only insert the blue key into key multiplier 1 if both pantographs are fully lowered.

Key Multiplier 1

- Insert the blue key in key multiplier 1 to release two black keys and one red key.
- The black keys are for the two pantograph grounding and lock down claws.
- The red key is covered by an extra lid. The red key is used for grounding the MCB to allow access to the HVC and ICF.

Grounding the High Voltage Cubicle

Mortal Danger!

To ground the MCB, the red key from key multiplier 1 must be used to release the mechanical lock of the grounding switch. When operating the grounding switch, do not look inside the HVC since possible flash-overs can cause eye injuries.

After the MCB is grounded, the yellow key is released and can be removed.

EDITION C: 2003. SEP. 15

Key Multiplier 2 (LVC)

Insert the yellow key into key multiplier 2 to release the five green keys, which are needed for accessing the doors of the following assemblies:

- 2 keys for the HVC
- 2 keys for the ICF
- 1 key for the roof hatch

HVC

After grounding, access to the HVC is safe if all warnings and instructions have been observed and no voltage is present on any of the high voltage components. Both pantograph disconnecting switches must be operated to allow correct functioning of the grounding switch!

Security

Two green keys are needed to open the HVC.

Warning!

Battery voltage may still be present on the low voltage equipment!

Closing the HVC

Before closing the HVC, everything that is not necessary for proper functioning of the HVC equipment must be removed from the cubicle!

ICF

Two green keys are needed to open the ICF.

Warning!

High voltages may still be present in the filter circuit, the HEP, the AUX circuits and the HEP output switches, and battery voltage may still be present on the low voltage equipment!

To ensure safe working conditions, both filter circuits and the HEP and the AUX circuits must

be checked for absence of voltage and must be grounded before carrying out any work.

You must use a high voltage indicator to check for absence of voltage.

Unlocking the doors

- Two green keys are needed to unlock the doors of the HVC.
- Two green keys are needed to unlock the doors of the ICF.
- One green key is needed to unlock the roof hatch.

A special tool is needed to open the converter doors. This must not be done before the complete procedure of the safety keys is finished! To ensure safe working conditions, the safety and grounding procedure, shown on the converter doors, have to be finished.

The dc-link must be checked for absence of voltage and must be grounded before carrying out any work on any equipment inside the converter cubicle!

You must use a high voltage indicator to check for absence of voltage.

B Operating Elements and Modes

4 Controls and Indicators

The controls and indicators for the ALP-46 locomotive are located in the two cabs and in the machine room. Most operating controls, switches, indicators and alarms are duplicated in each cab. The controls in the machine room are located on the Low Voltage Cubicle (LVC), the Auxiliary Supply and Distribution Cubicle (ASD) and on the Communication Cubicle (COM).

4.1 Engineer's desk

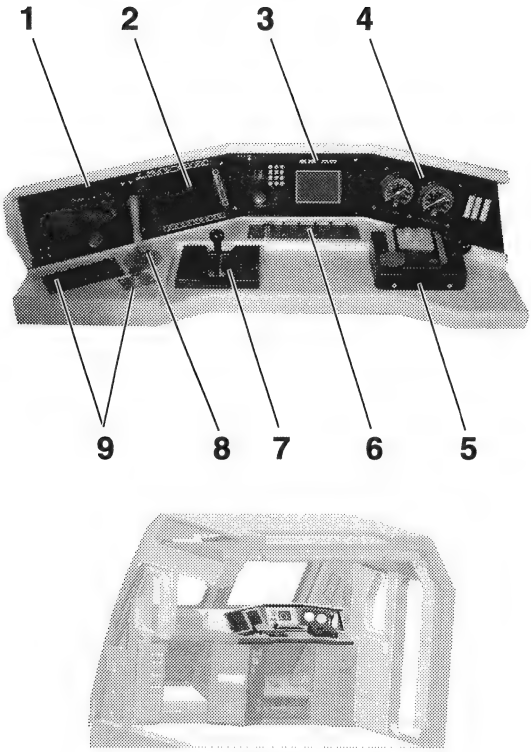


Figure B-1: Engineer's desk

#	Description
1	Radio
2	Diagnostic Display (IDU)
3	Speed/Aspect Display Unit (SDU)
4	Duplex Air Gauge
5	Brake Valve
6	Center Switch Panel (CDPM)
7	Controller
8	Horn Valve
9	Left Switch Panel (CDPL)

EDITION C: 2003. SEP. 15

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4.1.1 Left cab desk panel (CDPD)

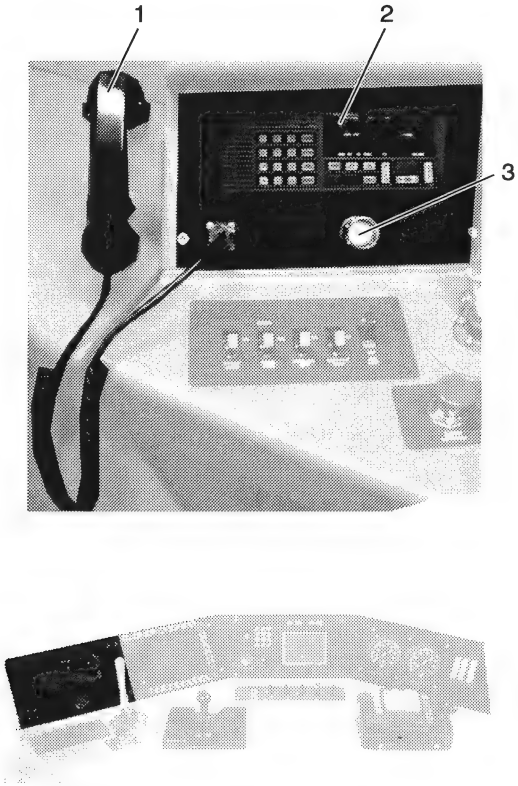


Figure B-2: Left cab desk panel (CDPD)

#	Description	Notes
1	Handset	
2	Radio	
3	Fault reset {163.1}	Illuminated push button for fault clearing.

EDITION C: 2003. SEP. 15

Motorola Clean Cab radio

This radio type is fitted to locomotives 4600 and 4601 only:

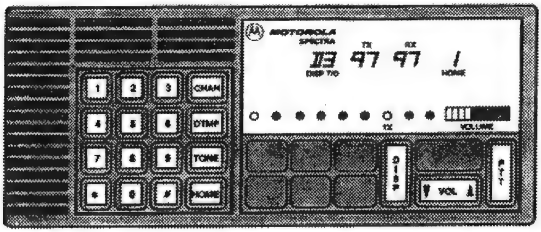


Figure B-3: Motorola Clean Cab radio

See the Motorola documentation (Operator's Manual 68P80102W61) for more information.

Radio Control Head for Harmon 12R Remote Radio :

This radio type is fitted to locomotive 4602 to 4628.

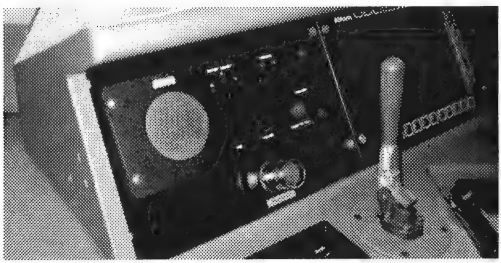


Figure B-4: Cab Desk Panel D (CDPD)

#	Description	Notes
1	Radio Control Head	Operator's Manual: see COMCO Documentation
2	Fault reset {163.1}	Illuminated push button for fault clearing.

Only the radio control head is mounted in panel CDPD on the engineer's desk. The HARMON

12R remote radio is located underneath the fireman's foot rest.

Select the required radio transmission channel by turning the two rotary controls for channel selection. The selected position is indicated by LEDs.

Press the Push To Talk Button to pass on messages via the built-in microphone.

Adjust the volume of the built-in loudspeaker with the rotary volume control.

EDITION C: 2003. SEP. 15

4.1.2 Intelligent display unit (IDU)

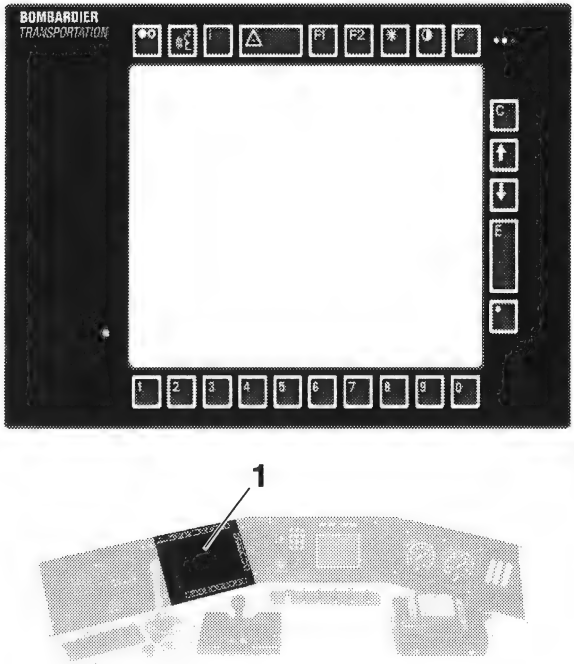
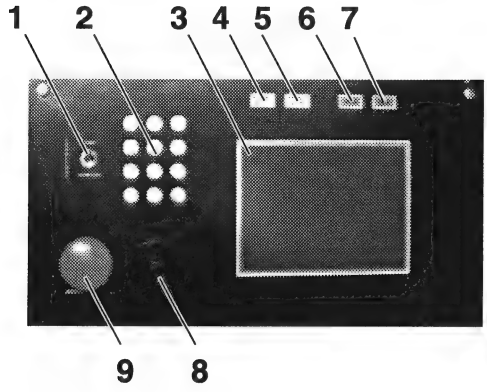


Figure B-5: Intelligent Display Unit (IDU)

#	Description	Notes
1	Display	See Chapter 5..

See “Using the intelligent display unit (IDU)” on page 175 for information on the display.

4.1.3 Speed display unit (SDU)



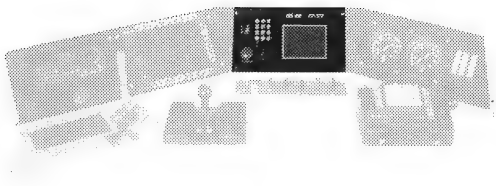


Figure B-6: Speed Display Unit (SDU)

#	Description
1	CSS Territory Selector Switch
2	Keypad
3	Flat Screen Display
4	Indicator SES Failed
5	Indicator CSS Failed
6	Indicator SES
7	Indicator CSS
8	Audible alert
9	Acknowledge push button

EDITION C: 2003. SEP. 15

Notes, item 1:

- CSS:
  Use when the train operates in a territory that has a Coded Carrier (100 Hz) signal in the rails.
- NON-CSS:
  Use in a territory without a Coded Carrier (100 Hz) signal in the rails. Placing the territory switch in this position allows for operation at up to 79 mph.

Notes, item 2:

A special password is used to access a maintenance menu where train data and version and CRC data for the different software packages is available.

This is used to initiate the System Departure Test.

Keypad inputs are transmitted serially to the SES from the SDU and to the CSS from the SDU.

Notes, item 3:

See "Flat screen display" on page 66.

Notes, item 4:

Indicator is dark (off) in normal operation, and red when [SES/CSS] system fails or is in Cut-Out

Notes, item 5:

ON red if the CSS system fails or is in Cut-Out

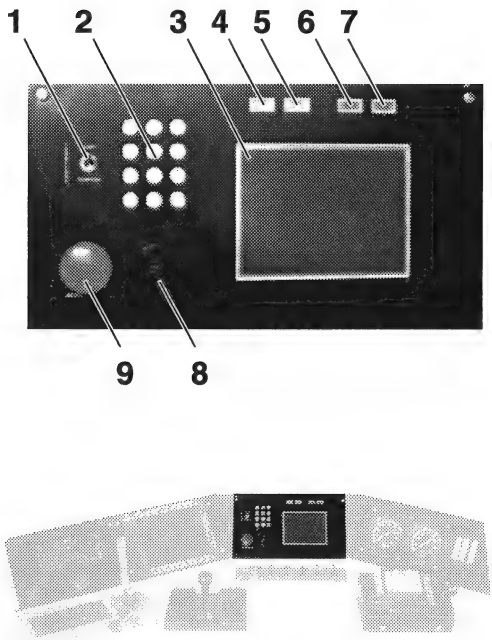


Figure B-7: Speed Display Unit (SDU)

Notes, item 6:

- ON green when the SES subsystem is active (transponder information is being used for speed enforcement)
- ON amber when the SES is not active (not using transponder information for speed enforcement)
- DARK (Off) when in a failed condition.

Notes, item 7:

- ON green when the CSS subsystem is active.
- ON amber when in NON CSS Territory.

EDITION C: 2003. SEP. 15

- FLASHING green when a code rate is detected, requiring that the Territory selector switch be placed in CSS position.
- DARK (Off) when in a failed condition.

Notes, item 8:

Provides the engineer with a number of sound patterns to indicate various system conditions.

- Alarm #1: Beeps at one-sixteenth second intervals on/off until acknowledged - Signal downgrade
- Alarm #2: Beeps at one-sixteenth second intervals on/off until underspeed or suppression has been achieved - Overspeed condition
- Alarm #3: Beeps at one-sixteenth second intervals on/off for one-half second period - Entering or exiting territories or missing transponders
- Alarm #4: Two beeps at half second intervals - SES braking profile warning

Flat screen display

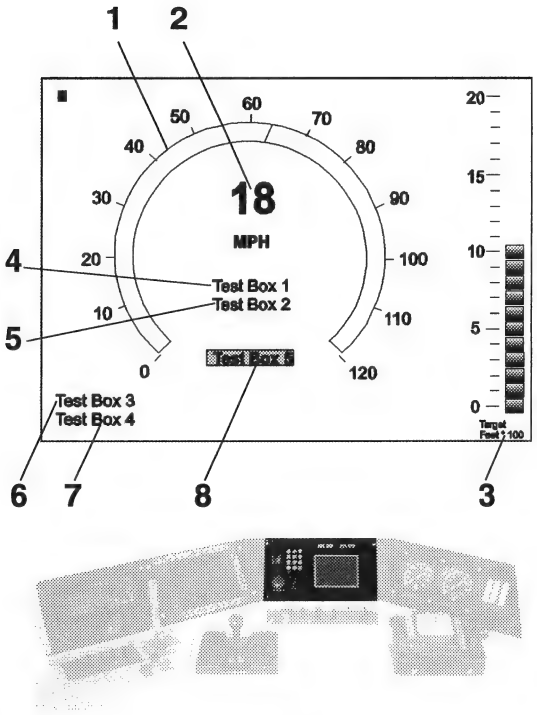


Figure B-8: Flat screen display

#	Description
1	Graphic Speed Display
2	Numeric Speed Display
3	Distance to target indication (The target distance scale is not displayed in CSS only and Non-Coded Territory.)
4	Text Box 1
5	Text Box 2
6	Text Box 3
7	Text Box 4
8	Text Box 5

EDITION C: 2003. SEP. 15

Notes, item 1:

- SES:
  Indicated as green increments from zero up to the authorized speed on the speed ring.
  No authorized speed is displayed on the speed ring when the SES is enforcing 79 mph.
- CSS:
  Shown as a green ring from zero mph up to the authorized speed threshold for each code rate except for a 180 code = MAS.

Notes, item 2:

- SES:
  Actual speed is always displayed as one black increment on the speed ring. The actual speed is also displayed as black numerals on the three digital displays in the center of the speed ring.
- CSS:
  Actual speed is always displayed as one black increment on the speed ring.
  The numerals in the center of the speed ring display actual speed in green when receiving Clear (180 code) MAS and in black otherwise.

Notes, item 3:

- SES:
  From zero feet to the distance to the target, the target indicator is illuminated in magenta.
  When no distance to target is available, the distance to target indicator is not illuminated.
- CSS:
  The target distance scale is not displayed in CSS only and Non-Coded Territory.

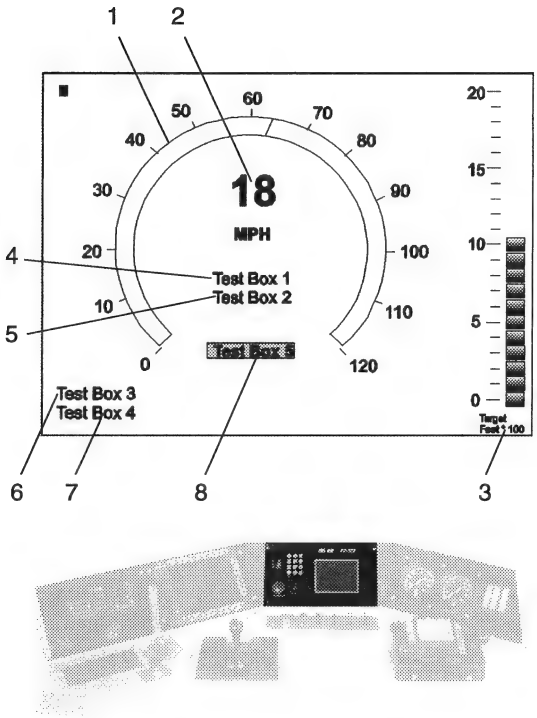


Figure B-9: Flat screen display

#	Description
1	Graphic Speed Display
2	Numeric Speed Display
3	Distance to target indication (The target distance scale is not displayed in CSS only and Non-Coded Territory.)
4	Text Box 1
5	Text Box 2
6	Text Box 3
7	Text Box 4
8	Text Box 5

Notes, item 4:

TRAIN STOP PENALTY is shown when a penalty indication is received.
OVERSPEED PENALTY is shown when an overspeed indication is received.
Text Box 1 is blank if neither of these conditions exists.

Notes, item 5:

Text Box 2 displays "Fwd/Rev Mismatch" or "Invalid Car Type". The box is blank if neither of these conditions exists.

Notes, item 6:

Text Box 3 displays various CSS status and failure messages. The box is blank if no message has been received.

Notes, item 7:

Text Box 4 displays departure test prompts or failure messages received from the CSS or the SES system. The box is blank if no message has been received.

Notes, item 8:

Suppression is displayed in black letters with a yellow background and a black border.

Text Box 5 illuminates in constant yellow, flashing yellow or no display, depending on the suppression message.

4.1.4 Gauge desk panel (CDPB)

The gauge desk panel, located to the right of the engineer's desk, contains two duplex air gauges and three vertical oriented indicators.

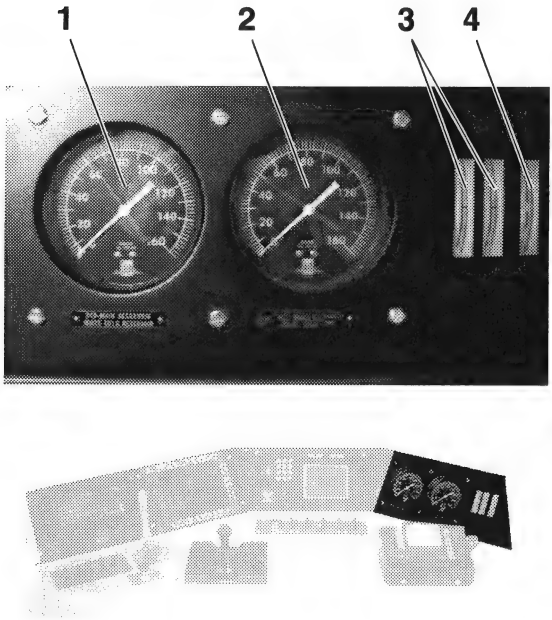


Figure B-10: Gauge desk panel (CDPB)

#	Description
1	Gauge for reservoirs
2	Gauge for brake
3	Tractive/Braking Effort meter
4	Catenary voltage meter

EDITION C: 2003. SEP. 15

Notes, item 1:

Double manometer which shows:

- RED: Main Reservoir (MR)
- WHITE: Equalizing Reservoir (EQ´LG)

Notes, item 2:

Double manometer which shows:

- RED: Brake Cylinder (BC Gauge)
- WHITE: Brake pipe (BP Gauge)

Notes, items 3 and 4:.

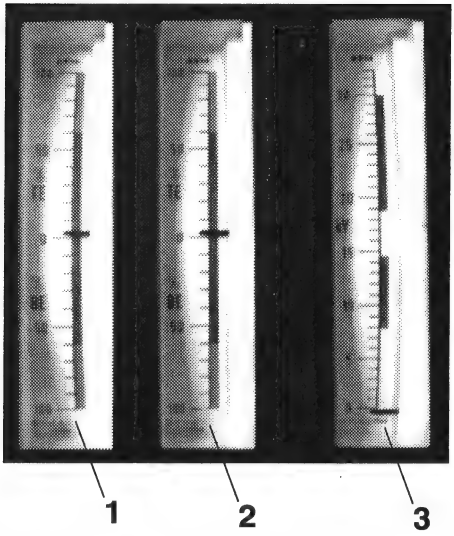


Figure B-11: TE/BE meters and catenary voltage meter

#	Description
1	Traction Effort/Braking Effort Meter, truck 1 {79.1}
2	Traction Effort/Braking Effort Meter, truck 2 {79.2}
3	Catenary Voltage meter {74}

Traction Effort/Braking Effort Meter

The two TE/BE meters indicate traction and braking effort for the two trucks. Zero TE/BE is at the center of the meter. Traction effort is shown in the upper half and braking effort in the lower half of each meter.

The meters have green and amber areas. The indication is directly related to the actual value of tractive effort, which corresponds to the traction motor current. If maximum load remains in the amber area for an extended period of time,

automatic power reduction occurs to avoid overheating the traction motors.

Catenary voltage meter

The catenary voltage meter indicates kilovolts available at the catenary.

The meter has two green areas, representing the permitted voltage range for the three different supply voltage systems. When the catenary voltage is out of tolerance (i.e. indicator out of the green areas) the MCB is opened automatically to avoid damage to the main power circuit of the locomotive.

4.1.5 Air brake controller

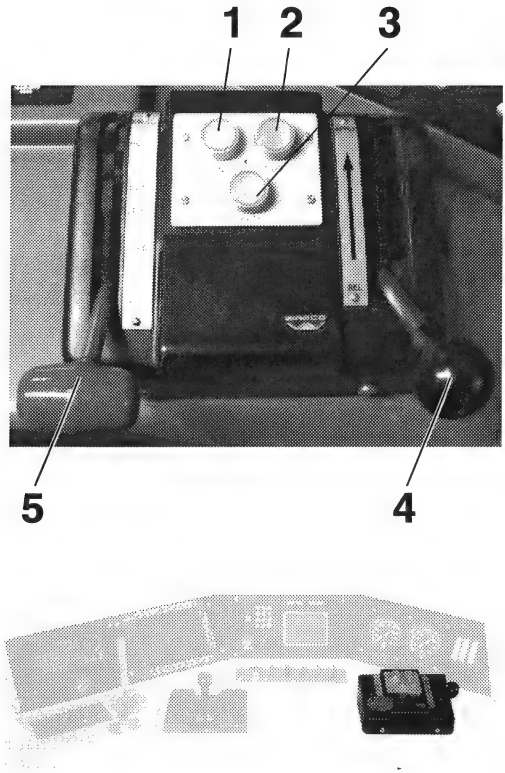


Figure B-12: Brake valves

#	Description
1	IN
2	OUT
3	TRAIL
4	Independent Brake Valve Handle
5	Automatic Brake Valve Handle

Automatic brake valve

The automatic brake valve controls the application and release of both locomotive and train brakes. The brake valve is a time depending type valve, used for holding brake pipe reductions constant against nominal brake pipe leakage. Its positions are:

- Release
- Hold
- Service
- Lap
- Handle Off (HO)
- Emergency

- Release charges the brake pipe and releases the train brake.
- Hold also recharges the brake pipe to its full pressure and provides for electric hold of the brakes on the train.
- Service reduces equalizing reservoir pressure at the service rate, and
- Lap stops any further pressure reduction of the equalizing reservoir.
- The handle must be in the Handle Off position in any non-operated cab.
- Emergency provides an emergency brake application.

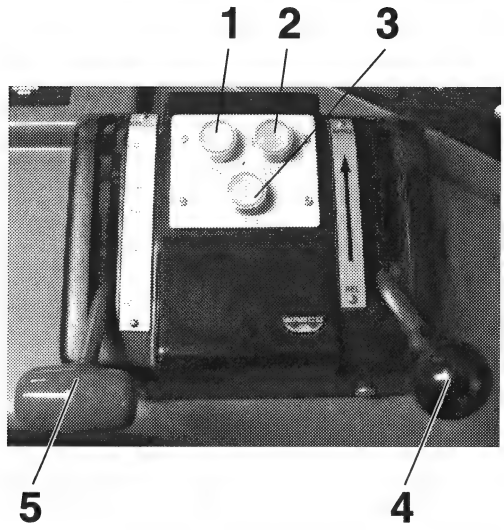


Figure B-13: Brake valves

#	Description
1	IN
2	OUT
3	TRAIL
4	Independent Brake Valve Handle
5	Automatic Brake Valve Handle

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Independent brake valve

Located to the right of the automatic brake valve, the independent brake valve is self-lapping and provides independent control of locomotive braking. It also allows the engineer to "Bail Off" an automatic brake application, if necessary, for proper train handling. Its positions are:

  - Release
  - Application Zone
  - Full Application
  - "Bail Off"
    (Handle depressed to the right)

- Release is the normal operating position, removing pressure from the brake cylinder.
- Application Zone allows the engineer to increase or decrease brake cylinder pressure on the locomotive.
- Full Application provides maximum brake cylinder pressure on the locomotive.

Backlit push buttons

The three backlit push buttons located between the automatic and independent brake handles are used to change operating modes for the Cab Control Portion: IN, OUT, TRAIL. See "Automatic brake" on page 251.

4.1.6 Center switch panel (CDPM)

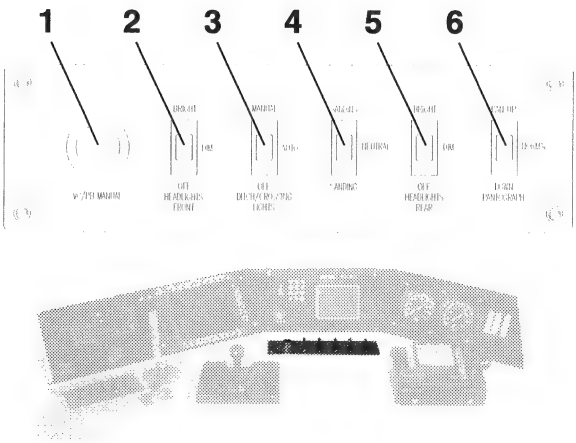


Figure B-14: Center switch panel (CDPM)

#	Description
1	VC/PB Manual {247.5}
2	Headlight Front {316}
3	Ditch/Crossing Lights {316.1}
4	Sand Switch {192.1}
5	Headlights Rear {317}
6	Pantograph Switch {129}

Notes, item 1: VC/PB Manual {247.5}

Purpose is to open MCB manually before crossing phase gap when automatic phase gap detection is out of order.

Notes, item 2:

Twin sealed beam headlights (2x200W / 30 V) are provided front and rear.

The front headlights are controlled by this switch. The switch has 3 positions:

– OFF - DIM - BRIGHT

Notes, item 3:

Ditch/crossing lights are mounted at each end of the locomotive. The purpose of the ditch/crossing lights is:

– to warn other traffic
– to support the head lights in the position "BRIGHT"

Notes, item 4: Sand Switch {192.1}

The vehicle control will activate sanding automatically when requested by the wheel slip control.

If the engineer feels additional sanding to be necessary, it can be requested by operating the sand switch either way, up or down (both non-latching).

The sand switch operates the sand magnet valves to apply sand in the direction of locomotive travel. The electrical control of sanding is trainlined for control throughout the train consist.

The vehicle control activates the indication light "Sanding" {192.2} (CSP3) whenever a sanding operation is active.

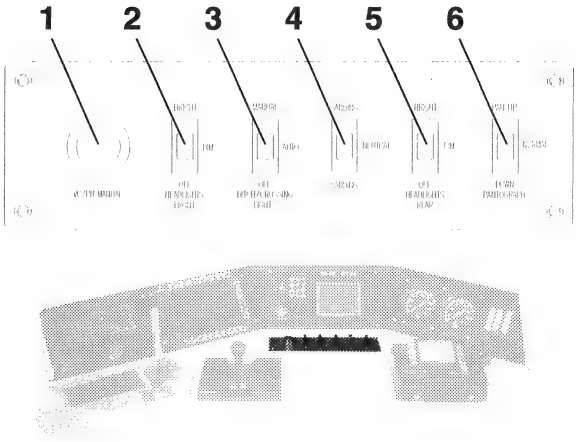


Figure B-15: Center switch panel (CDPM)

#	Description
1	VC/PB Manual {247.5}
2	Headlights Front {316}
3	Ditch/Crossing Lights {316.1}
4	Sand Switch {192.1}
5	Headlights Rear {317}
6	Pantograph Switch {129}

Notes, item 5: Headlights Rear {317}

The rear headlights are controlled by this switch. The switch has 3 positions:

– OFF - DIM - BRIGHT

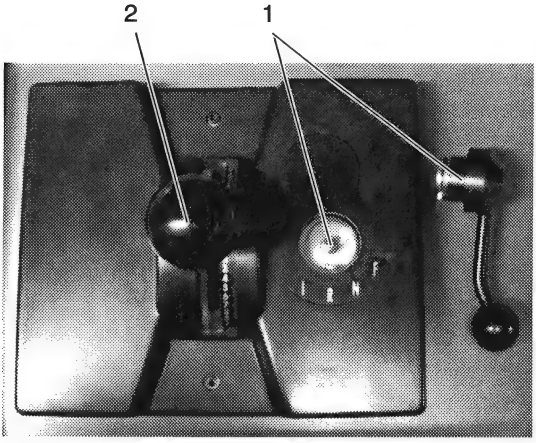
To set the leading locomotive in multiple operation, the Headlights MU switch {317.1} (CRWPF) must be in the correct position. Otherwise the rear headlights of both locomotives will be on.

Notes, item 6:

The toggle switch is provided to raise and lower the pantograph.

– UP raise pantograph (non latching)
– NORMAL no change (latched)
– DOWN lower pantograph (latched)

4.1.7 Controller



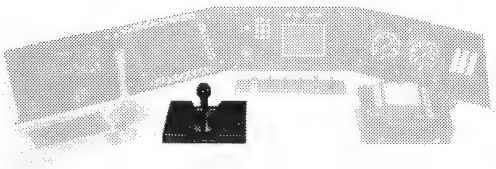


Figure B-16: Controller {150}

#	Description
1	Reverser
2	Throttle

The controller, located on the engineer's desk, has two handles: reverser and throttle (Figure B-16). The reverser determines locomotive direction and movement. The throttle controls locomotive power in both motoring and dynamic braking modes.

Notes, item 1: Reverser

The driving direction is selected by using the reverser handle in the activated cab. The reverser is located to the right of the throttle. It has four detent positions:

- I isolated (cab not activated)
- R reverse (cab activated, reverse driving direction)
- N neutral (cab activated, no active driving direction)
- F forward (cab activated, forward driving direction)

Neutral (N) is used when the locomotive is at a standstill and the controls are being attended.

Isolate (I) de-energizes control system functions to prevent locomotive movement. It is used when the locomotive is unattended or when changing operating ends.

Forward (F) and Reverse (R) directions are determined by the operated cab.

The engineer cannot remove the reverser handle unless the throttle is in the zero position and the reverser is in Isolate (I).

With the reverser in Neutral (N), most of the locomotive control circuits remain energized. However, the control circuits for the Forward, Reverse, Motoring and Braking functions cannot be activated.

Warning!

Always set the reverser to isolate before leaving the cab!

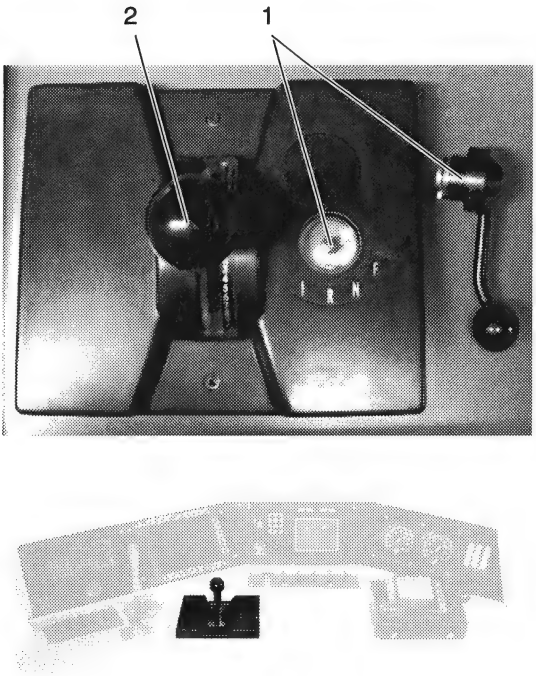


Figure B-17: Controller

#	Description
1	Reverser
2	Throttle

Notes, item 2: Throttle

The throttle has three functional sections:

- Dynamic Braking position B1 through B9 and F
- Neutral position 0 (detent)
- Motoring positions P1 through P9 and F

The position of the reverser handle cannot be changed unless the throttle is in the zero position. The throttle handle is locked in the zero position unless the reverser handle is in either the F, N or R position.

Moving the throttle backward controls power during the motoring mode of operation. Moving the handle forward controls power during dynamic braking.

The engineer must move the throttle out of the detent 0 position before moving it forward or backward.

Motoring zone positions P1 through F and Braking zone positions B1 through F are stepless control zones. Pulling back the throttle from 0 to P1 through F increases tractive effort. Pushing forward the throttle from 0 to B1 through F increases dynamic braking effort.

The maximum braking power for system 3 can be set using the TDS Uploader tool.

4.1.8 Horn valve

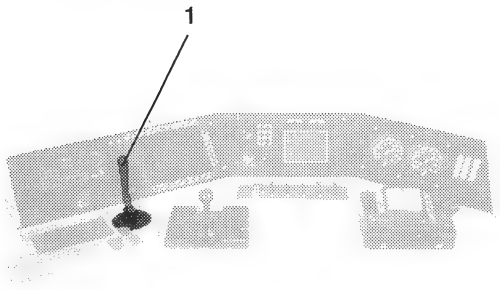


Figure B-18: Horn valve

#	Description
1	Modulating Horn Valve

The horn is controlled by the modulating horn valve, located on the left side of the engineer's desk.

Simultaneously with horn actuation, the Vehicle Control will activate the bell until the push button "Bell" {187.6} on the Bell Switch Panel (CDC1) is pressed by the engineer to cancel bell operation. As long as the horn valve is operated no cancelling of bell actuation is possible.

The horn is also controlled by the horn foot switch {187.4} which is located on the left side of the foot plate (CFP) under the engineer's desk (see "Foot switch plate (CFP)" on page 100).

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4.1.9 Left switch panel (CDPL)

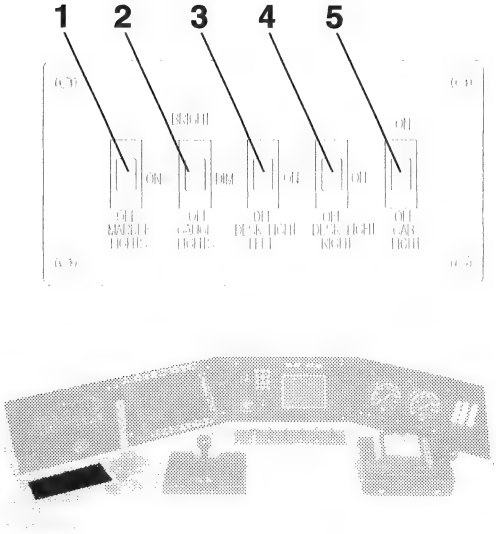


Figure B-19: Left switch panel (CDPL)

#	Description	Notes
1	Marker Lights	Switch {316.2}
2	Gauge Lights	Switch {324.3}
3	Desk Light Left	Switch {324.22}
4	Desk Light Right	Switch {324.21}
5	Cab Light non-latching	Switch {324},

Notes, item 1: Marker Light Switch {316.2}

Two single aspect LED marker lights are provided on each front and rear nose of the locomotive. The switch in each cab controls the corresponding marker light.

The marker lights have to be set at the rear end of the train, as required by the NJTransit Operating Rules.

Notes, item 2: Gauge Light Switch {324.3}

The engineer can select the brightness of the background lighting of the gauges/meters with the toggle switch in three steps:

- OFF
- DIM
- BRIGHT

The gauge lights are activated when the toggle switch position is in the Dim or Bright position, and they are turned off when the switch is set to Off position. The position of this switch affects the brightness of the indication light in the following way: Illuminating the gauges dims the indication lights.

Notes, item 3: Desk Light Left Switch {324.22}

The Desk Light Left switch controls the left desk light {325.22}. The desk lights are adjustable to focus on a certain area of the desk.

Notes, item 4: Desk Light Right Switch {324.21}

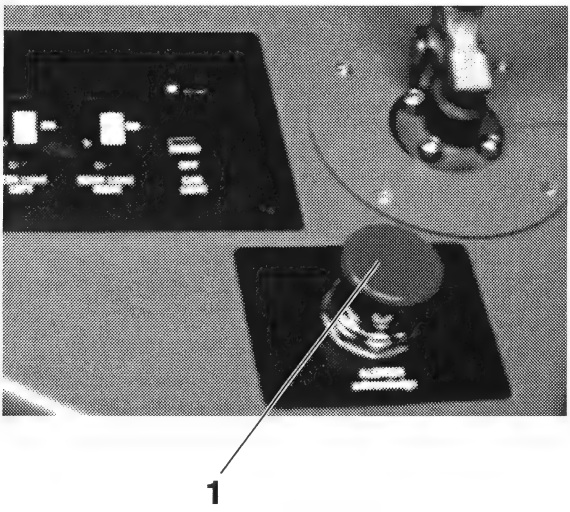
The Desk Light Right switch controls the right desk light {325.21}. The desk lights are adjustable to focus on a certain area of the desk.

Notes, item 5: Cab Light Switch {324}

This non latching toggle switch operates the cab light. The cab light also can be operated by the engineer side {324.11} and fireman side {324.12} push buttons on the cab side wall, next to the cab doors.

If the Battery Contactor Switch {125} (on CRWPF) is OFF, the cab light is timer controlled. The light will then go off automatically after 30 minutes.

4.1.10 Alerter acknowledge push button



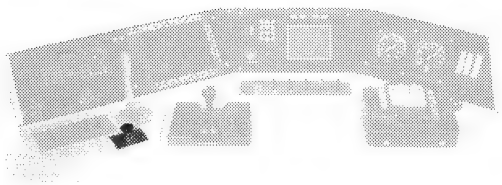


Figure B-20: Alerter Acknowledge Push Button {236}

#	Description
1	Alerter Acknowledge Push Button

The Alerter monitors the engineer's actions and repeatedly requests an acknowledgment during locomotive operation. Failure to acknowledge reduces the power to zero and applies the brakes at a full service penalty application.

The Alerter Acknowledge Push Button acknowledges the alertness alarm and resets the Alerter timer function and active penalties.

Resetting the Alerter alarm is also possible by operating any of the following controls:

- ATC Acknowledge push button on the SDU {94.3} (CDPA)
- ATC acknowledge foot switch {235} (CFP)
- Horn foot switch {187.4} (CFP)
- Bell push button {187.6} (CDC1)
- Throttle
- EP brake applied (EPIC relay 20)
- EPIC relay 13
- Horn Valve

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4.2 Desk consoles (CDC)

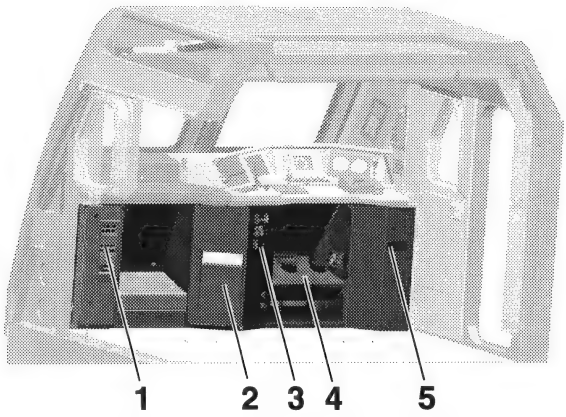


Figure B-21: Desk Consoles (CDC) and Foot Switch Plate (CFP)

#	Description
1	Desk Circuit Breaker Panel (CDC5)
2	Garbage Pail
3	HVAC Control Panel (CDC2)
4	Foot Switch Plate (CFP)
5	Bell Switch Panel (CDC1)

4.2.1 Desk circuit breaker panel (CDC5)

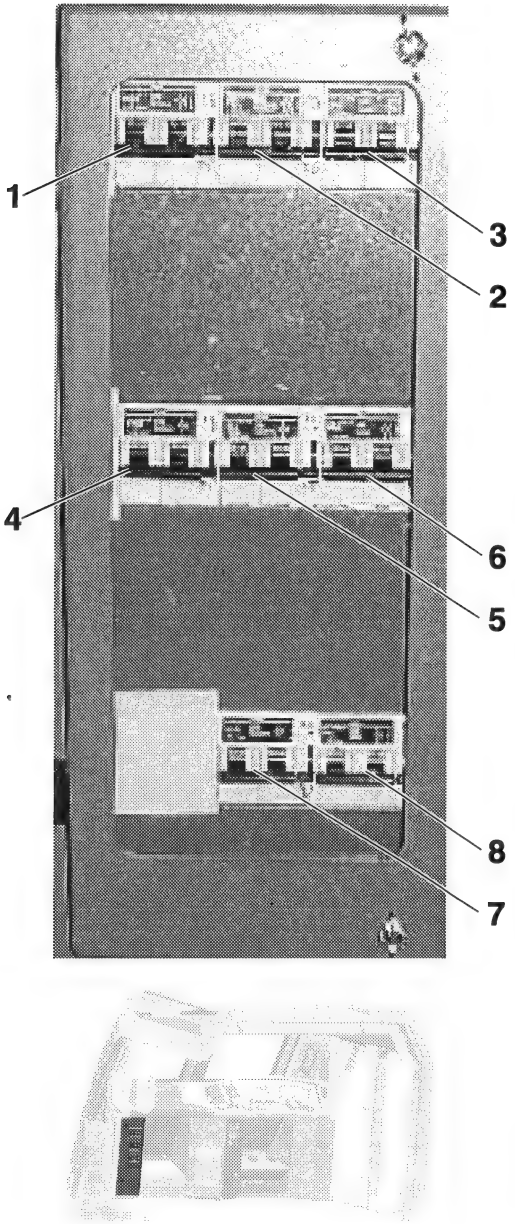


Figure B-22: 24 V DC circuit breakers (CDC5)

#	Circuit breaker	Protects
1	Wiper control right {127.51}	Windshield Wiper Engineer Side
2	Desk light right {127.55}	Desk Light Engineer Side
3	CAB electronics P {127.52}	Cab Control electronics on Primary Bus
4	Wiper control left {127.53}	Windshield Wiper Fireman Side
5	Desk light left {127.56}	Desk Light Fireman Side
6	CAB electronics S {127.54}	Cab Control electronics on Secondary Bus
7	PA/IC unit {351.33}	PA/IC unit
8	CAB electronics I {127.59}	Cab Control electronics on Independent Supply

4.2.2 Garbage pail

The garbage pail is used for disposal of rubbish. Do not use it for hot ash or other items which could cause a fire.

4.2.3 HVAC control panel (CDC2)

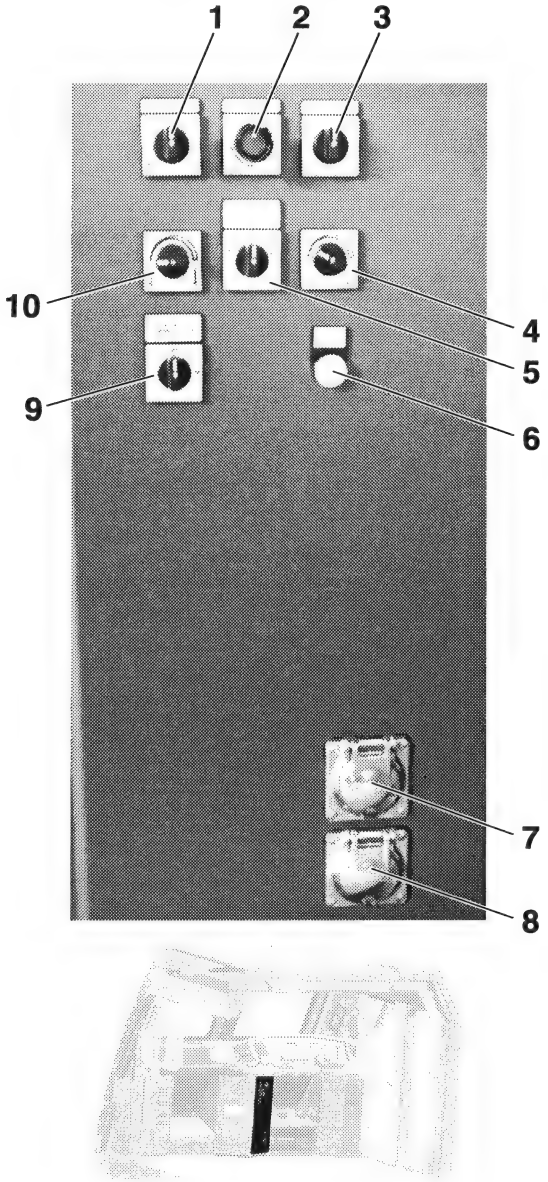


Figure B-23: HVAC control panel (CDC2)

#	Description
1	Windshield Wiper Fireman Side {288.3}
2	Windshield Heater Push Button {65.3}
3	Windshield Wiper Engineer Side {288.4}
4	HVAC Fan Speed {863.5}
5	HVAC Mode Switch {863}
6	Fresh Air Flap/Closed {873.2}
7	110 VAC 60 Hz Receptacle {335.1}
8	110 VAC 60 Hz Receptacle {335.1}
9	Cab Heater Switch {863.6}
10	Engineer's Cab Temperature Select {862.1}

Notes, items 1 and 3: Windshield Wiper Switches {288.3} and {288.4}

The HVAC control panel has separate windshield wiper control switches for the engineer and fireman's side. The switch has the following wiper modes:

–	Off	Wiper is in park position
–	Intermittent	Wiper runs intermittently in slow speed
–	Slow	Wiper runs in slow speed
–	Fast	Wiper runs in high speed

Each wiper control switch also has a bugwasher push button. The windshield washer reservoir is located in the cab rear wall below the locker.

Notes, item 2: Windshield Heater Push Button {65.3}

The illuminated windshield heater push button controls defrosting and de-icing of both windshields in the activated cab.

The push button is lit whenever the windshield heater is ON.

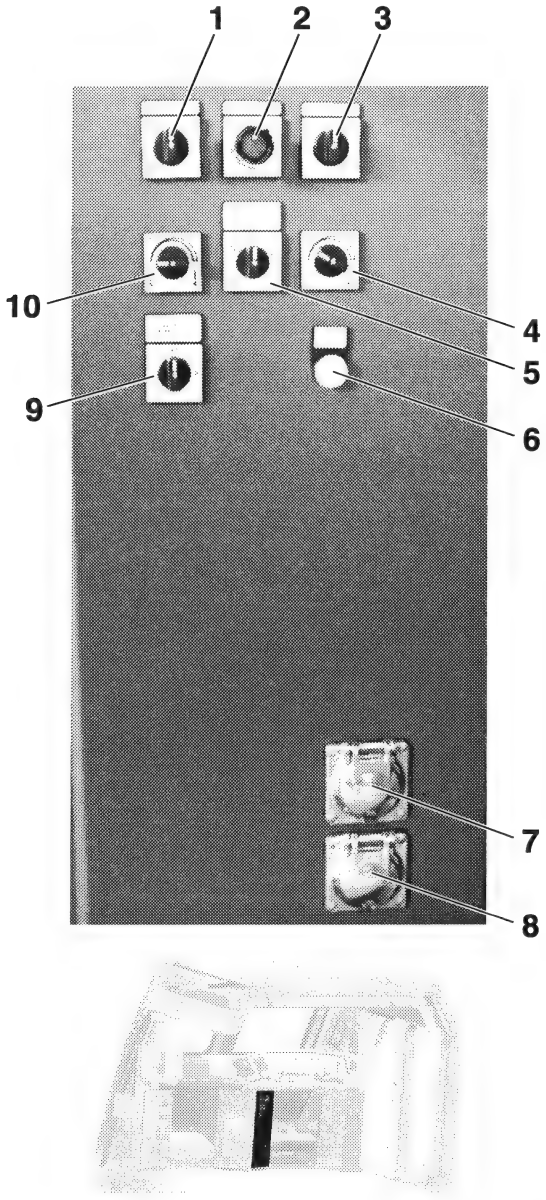


Figure B-24: HVAC control panel (CDC2)

Notes, item 4: HVAC Fan Speed {863.5}

Allows manual selection of the fan speed in the HVAC modes 'Manual' and 'Ventilation'.

Notes, item 5: HVAC Mode Switch {863}

Allows selection of one of the four HVAC modes 'Off', 'Ventilation', 'Manual' and 'Automatic'.

Notes, item 6: Fresh Air Flap Push Button {873.2}

Allows manual control of the fresh air flap inside of the HVAC e.g. when driving through tunnels and indicates whether the fresh air flap is open, closed or faulty. The associated indicator {873.2} will light if the fresh air flap is closed or will flash if the fresh air flap is faulty (stuck closed).

Mortal Danger!

When the fresh air flap is closed for a longer period, a rising concentration of CO gas may be hazardous for the health of the personnel in the cab or cause drowsiness! In case of a fault of the fresh air flap, it is recommended to open the window to get fresh air into the cab.

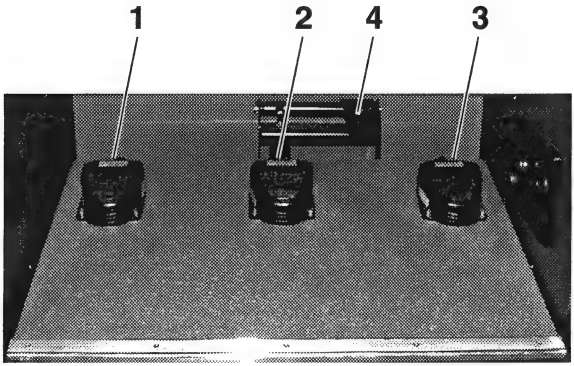
Notes, item 9: Cab Heater Switch {863.6}

Switches both additional cab heaters on and off. The cab heaters are located in the cab rear wall. The additional cab heaters should only be used under very cold weather conditions or to heat up the cab quickly. The additional cab heaters may support the main cab heater integrated in the HVAC unit. Normally the cab heaters are off. Then heating power is controlled by the HVAC unit automatically

Notes, item 10: Engineer's Cab Temperature Selector {862.1}

Allows manual selection of the cab temperature in the HVAC mode 'Manual'.

4.2.4 Foot switch plate (CFP)



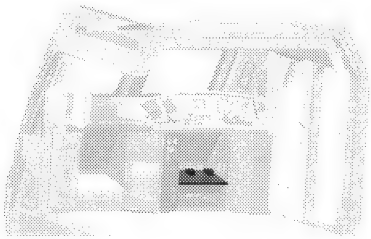


Figure B-25: Foot Switch Plate (CFP)

#	Description
1	Horn Foot Switch {187.4}
2	Acknowledge foot switch {235}
3	Door Override foot switch {702}
4	Foot Switch Plate lifting device

Notes, item 1: Horn Foot Switch {187.4}

The horn is controlled by the horn foot switch {187.4}, located on the left side of the foot plate (CFP) under the engineer's desk. The horn is also controlled by the modulating horn valve, located on the left hand side of the engineer's desk.

Cab activation is not necessary to sound the horn.

Whenever a foot switch horn is activated, the Vehicle Control will activate the bell until the push button "Bell" {187.6} on the Bell Switch Panel (CDC1) is pressed by the engineer to cancel bell operation. As long as the horn foot switch is operated no cancelling of bell actuation is possible.

Notes, item 2: Acknowledge Foot Switch {235}

- Pressing the acknowledge foot switch provides cab signal acknowledgment and resets the alerter timer.

Notes, item 3: Door Override Foot Switch {702}

- Pressing the door override foot switch prevents all doors in the train from being opened.

4.2.5 Bell switch panel (CDC1)

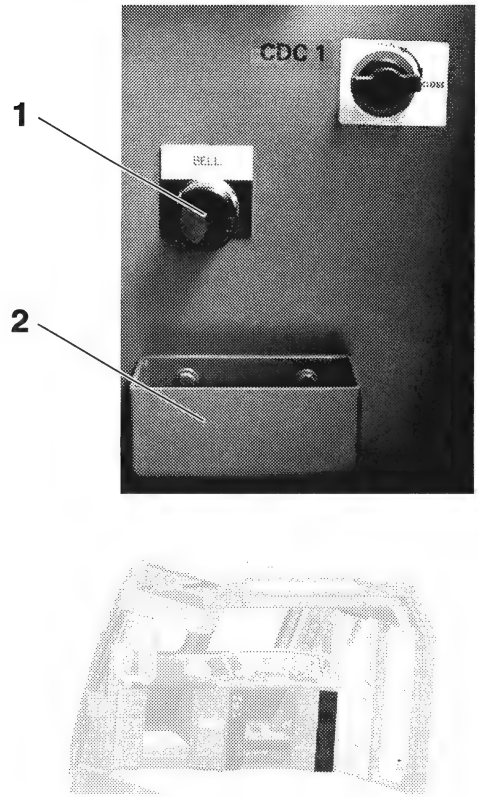


Figure B-26: Bell Switch and Reverser Holder (CDC1)

#	Description
1	Bell Push Button {187.6}
2	Reverser Holder

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Notes, item 1:

The engineer presses the bell push button {187.6} in any cab to request bell activation from the Vehicle Control. The Vehicle Control will activate the bell until the push button is pressed again.

If the bell has been activated by requesting the horn (ref. chapters 4.1.8 and 4.2), the Bell push button {187.6} must be pressed to stop bell operation.

Notes, item 2:

The reverser holder is a box which the engineer can use to store the reverser handle.

4.3 Cab side wall panels

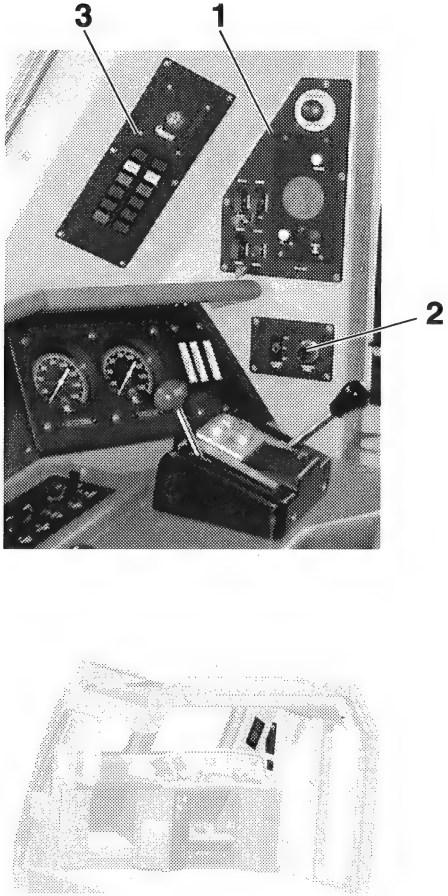

Figure B-27: Cab side wall

#	Description
1	Cab Side Panel 1 (CSP 1)
2	Cab Side Panel 2 (CSP 2)
3	Indication Light Panel (CSP 3)

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Cab side panel 1 (CSP1)

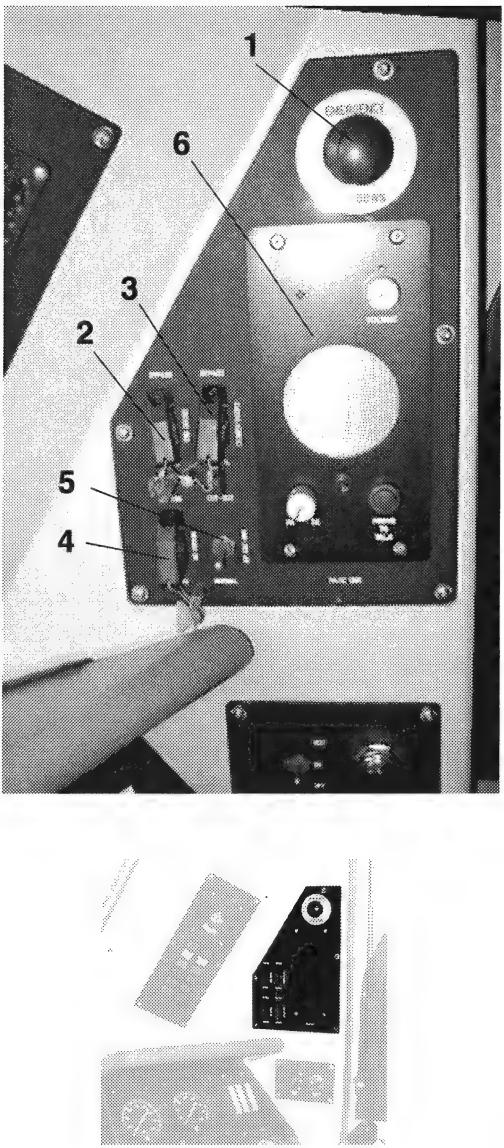

Figure B-28: Cab Side Panel 1 (CSP1)

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#	Description
1	Emergency Shutdown Push Button {233}
2	End Doors Bypass Switch {705.7}
3	Center Doors Bypass Switch {705.6}
4	No Motion Bypass Switch {705}
5	EP Cut-Out Switch {274}
6	PA/IC Unit {356}

Notes, item 1: Emergency Shutdown Push Button {233}

The Emergency Shut Down Push Button is a safety device to switch off main power to the locomotive immediately.

This mushroom type push button opens the MCB directly (hardware controlled).

The electronics will

- activate the pantograph down command on the trainline {TL 14T PD}
- stop the converters
- lower the local pantograph

Notes, item 2:

The End Doors Bypass Switch is a sealed cut-out switch to bypass the end door control circuit.

Notes, item 3:

The Center Doors Bypass Switch is a sealed cut-out switch to bypass the center door closed circuit.

Notes, item 4:

The No Motion Bypass Switch is a sealed cut-out switch to bypass the no motion circuit.

Notes, item 5:

The EP Cut-Out Switch is used to cut out the EP brake for brake testing, for light loco operation or in case of EP brake failure.

Notes, item 6:

The engineer can select either the „PA“ (Public Address) or „IC“ (InterCom) function with the rotary selector switch.

Press the „Push To Talk“ button to pass on messages via the built-in microphone to the passengers (PA) or to the train crew (to another communication control panel in the train; IC) depending on the position of the selector switch.

The red LED is illuminated as long as the Press To Talk button is depressed.

The engineer can listen to the conductor's InterCom messages (switch position IC) or to both Public Address and InterCom messages (position PA). Adjust the volume of the built-in loudspeaker with the rotary volume control.

EDITION C: 2003. SEP. 15

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4.3.1 Cab side panel 2 (CSP2)

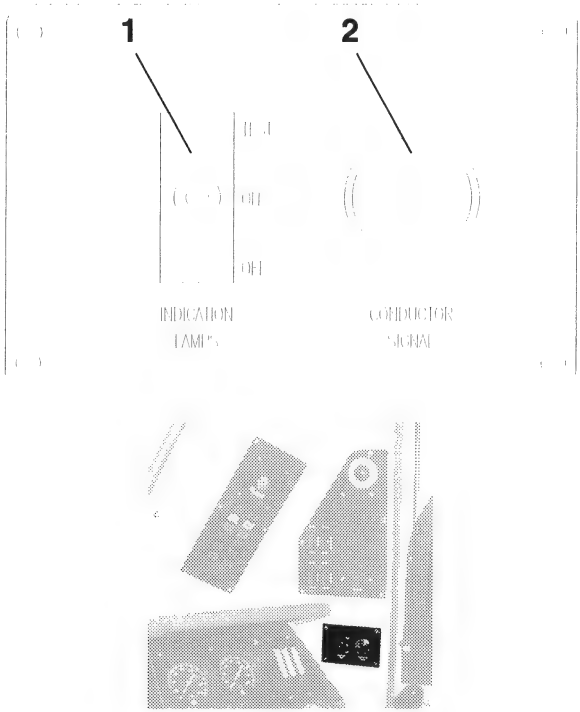

Figure B-29: Cab Side Panel 2 (CSP2)

#	Description
1	Indicator Lamp Test Switch {324.5}
2	Conductor Signal Push button {720.1}

Notes, item 1:

The purpose of the indicator lamp test is to verify that all indicator lamps are working. During the test the engineer must check for any defective indicator lamps.

The 3 position toggle switch allows you to activate the indicator lamp test. The positions are

- OFF — all indicator lamps are off at all times
- ON — all indicator lamps are enabled (default position for train operation)
- TEST — indicator lamp test and buzzer test requested manually

An automatic indicator lamp and buzzer test is carried out whenever the cab is activated and the switch is not in the "off" position.

- all indicator lamps controlled by the software are activated (full brightness, 5 s)
- the 3 buzzer frequencies are sequentially activated for 1 s each.
- The analog instruments TE/BE and Catenary Voltage are set to their maximum and minimum values.

The buzzer test is only carried out automatically on the first cab activation.

Notes, item 2:

The conductor signal push button is for conductor/engineer communication.

The engineer presses the push button to notify the conductor.

The buzzer, located in the cab rear wall, is activated simultaneously.

4.3.2 Indication light panel (CSP3)

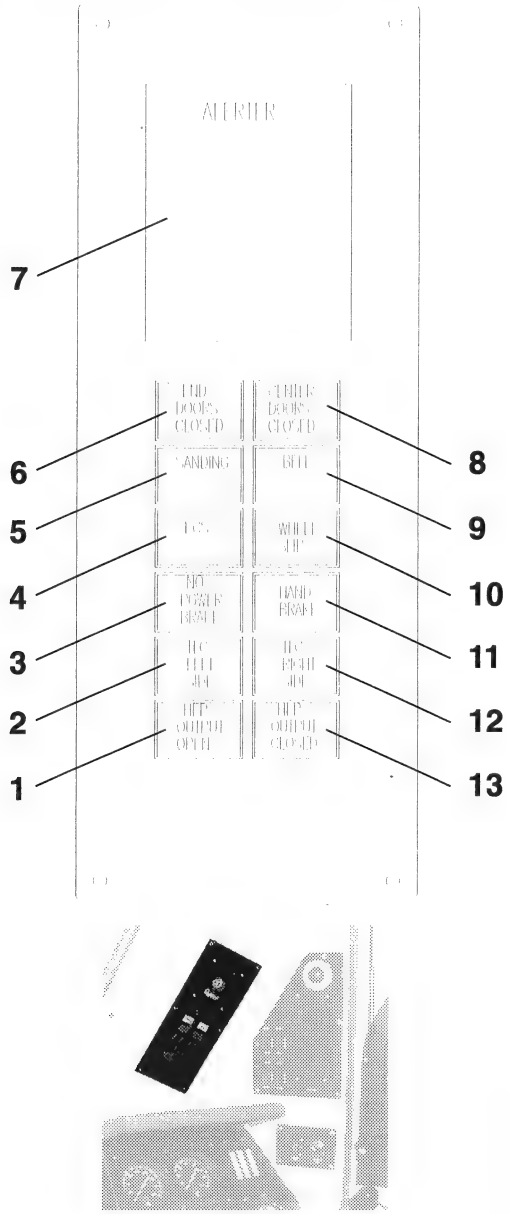

Figure B-30: Indication light panel (CSP3)

EDITION C: 2003. SEP. 15

#	Description	Notes
1	HEP OUTPUT OPEN	Indicates an opened HEP trainline contactor
2	TLC LEFT SIDE	Indicates a complete trainline on the left side
3	NO POWER BRAKE	Traction power interlock due to brake application while throttle in traction position
4	PCS	A Penalty service or any emergency air brake is active
5	SANDING	Indicates an active sanding operation
6	END DOORS CLOSED	All End doors closed
7	ALERTER INDICATION	Indicates that the alerter must be pressed. The Alerter Buzzer is also operated.
8	CENTER DOORS CLOSED	All center doors closed
9	BELL	Indicates bell action
10	WHEEL SLIP	Indicates an active adhesion control
11	HAND BRAKE	Indicates an applied hand brake in the train consist
12	TLC RIGHT SIDE	Indicates a complete trainline on the right side
13	HEP OUTPUT CLOSED	Indicates a closed HEP trainline contactor

4.4 Cab F rear wall

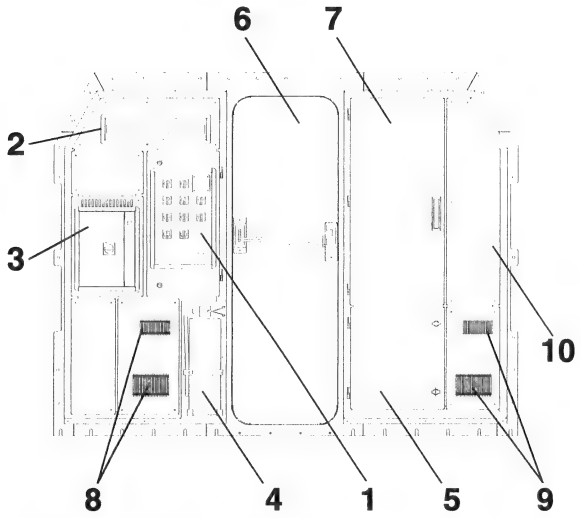

Figure B-31: Cab F rear wall

#	Description
1	Switch Panel Rear Wall Cab F (CRWPF)
2	Local Circuit Breakers Panel (CRWC1)
3	Thermo Box {481} (CRWC3)
4	Fire extinguisher
5	Box for Torpedoes/fuses; Windshield Washer Reservoir
6	Machine Room Door
7	Wardrobe with card holder on cover and emergency cellphone handset
8	Cab Heater {69} (CRWC4)
9	Cab Heater {69} (CRWC6)
10	Alarm Panel (CRWC5)

EDITION C: 2003. SEP. 15

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4.4.1 Switch panel, Cab F rear wall ctd.

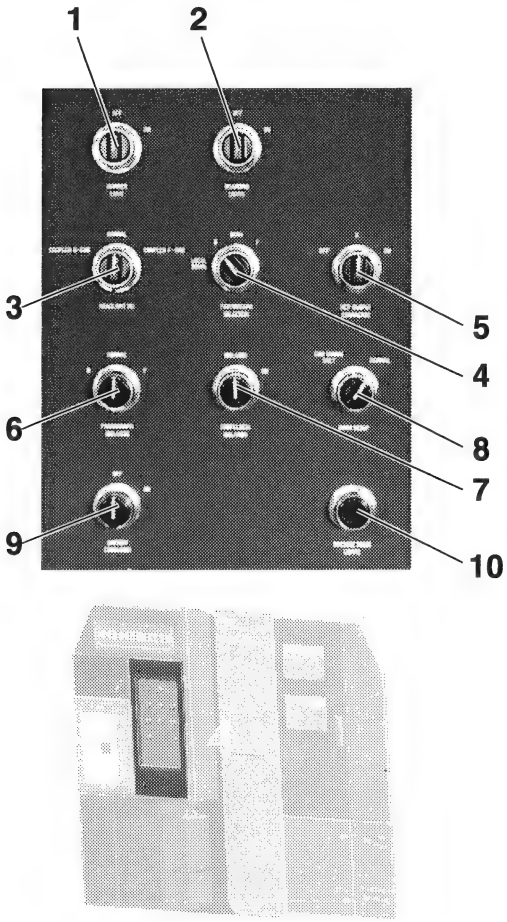

Figure B-32: Switch panel, Cab F rear wall (CRWPF)

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#	Description
1	Number Light Switch {316.6}
2	Boarding Lights Switch {316.4}
3	Headlights MU Switch {317.1}
4	Pantograph Selection Switch {129.2}
5	HEP Output Contactor Release Switch {32.11}
6	Pantograph Isolation Switch {129.3}
7	Propulsion Isolation Switch {156}
8	Door Setup Switch {701}
9	Battery Contactor Switch {125}
10	Machine Room Lights Push Button {327}

Notes, item 1: Number Light Switch {316.6}

This number light switch controls the locomotive identification light on the Cab F end.

Notes, item 2: Boarding Lights Switch {316.4}

This boarding light switch controls the step/boarding lights on the Cab F end.

Notes, item 3: Headlights MU Switch {317.1}

The Headlights MU Switch turns off the headlights for cabs facing each other during MU (multiple unit) operation and controls the operation of the headlight on the trailing end of the second locomotive.

The switch has 3 positions:

- Coupled F — cut out the headlights at the cab F end
- NORMAL — no headlights are cut out
- Coupled B — cut out the headlights at the cab B end

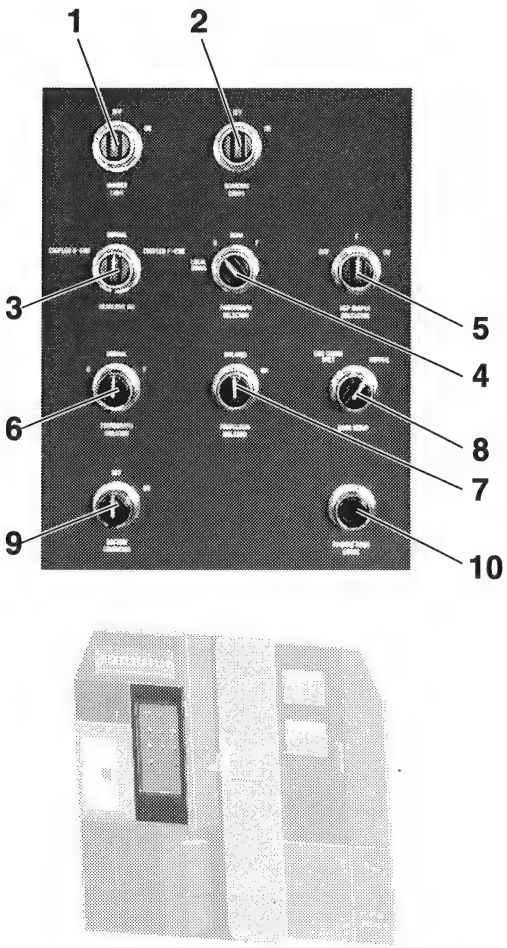


Figure B-33: Switch panel, Cab F rear wall (CRWPF)

Notes, item 4: Pantograph Selection Switch {129.2}

The pantograph selection switch has the following positions:

– F	raise pantograph "F" only
– BOTH	raise both pantographs
– B	raise pantograph "B" only
– LOCAL DOWN	don't raise pantographs on this vehicle

Warning!

Locomotive operation with both pantographs raised is only allowed when one of the pantographs is isolated!

Notes, item 5: HEP Output Contactor Switch {32.11}

The HEP output contactor switch is used to release the 480V power to the HEP TL (trainline). The HEP output contactor cannot close until the switch is set to the ON position. The HEP output contactor switch is spring-loaded and returns to the neutral position in the middle after being operated by hand. The actual state of the HEP output contactor is visible in the Indication Light Panel CSP3 on the side wall of the cab.

Notes, item 6: Pantograph Isolation Switch {129.3}

The pantograph isolation switch has the following positions:

- F isolate pantograph above cab F
- NORMAL neither pantograph is isolated
- B isolate pantograph above cab B

It is not possible to isolate both pantographs at the same time.

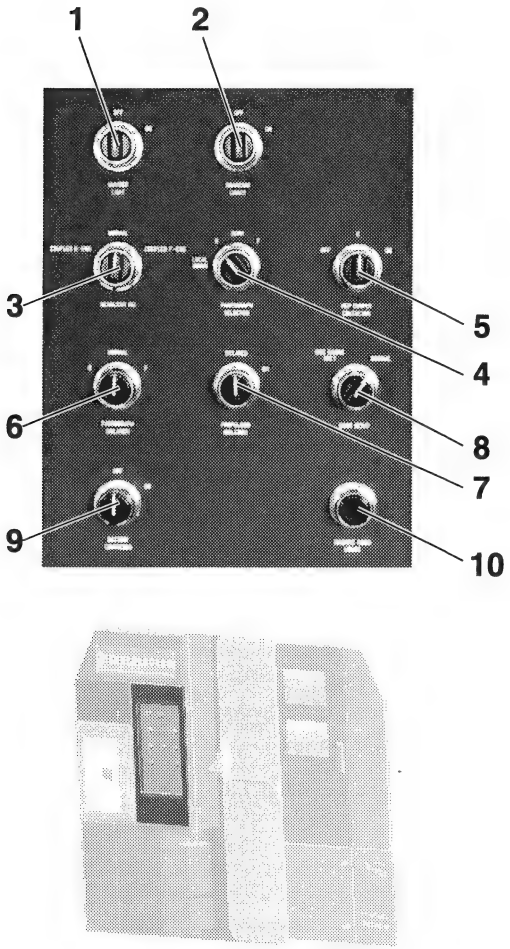


Figure B-34: Switch panel, Cab F rear wall (CRWPF)

Proceed as follows to set up freezing rain:

- Lower pantographs
- Set Pantograph Selection Switch to BOTH
- Set Pantograph Isolation Switch to F or B (leading pantograph must be isolated!)
- Raise the pantographs

Proceed as follows to cancel freezing rain:

- Lower pantographs
- Set Pantograph Selection Switch to F or B (depending on next driving direction)
- Set Pantograph Isolation Switch to NORMAL
- Raise the pantograph

Notes, item 7: Propulsion Isolation Switch {156}

The Propulsion Isolation Switch must be ON during power and dynamic brake operation.

The ISOLATED position disables the propulsion systems and prevents any motoring or dynamic brake of the locomotive.

The Propulsion Isolation Switch does not affect HEP system.

Note!

It is recommended to isolate the propulsion when leaving the locomotive unattended with raised pantograph.

Notes, item 8: Door Setup Switch {701}

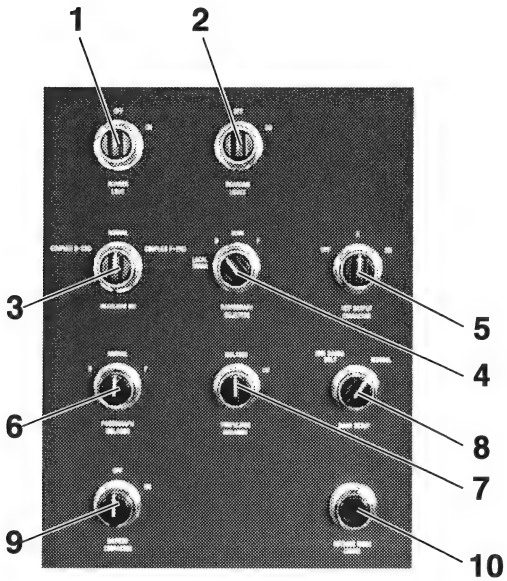
The Door Setup Switch selects the door control trainline signals to the type of cars in the train consist.

Operate the Door Setup Switch as follows:

- Choose position “End Doors” for cars with end doors only
- Choose position “Center Doors and End Doors” for cars with center and end doors

The purpose of the Door Setup Switch is to use certain trainline signals differently when Comet II class coaches or Comet III class coaches are used.

Switch panel, Cab F rear wall (CRWP), ctd.



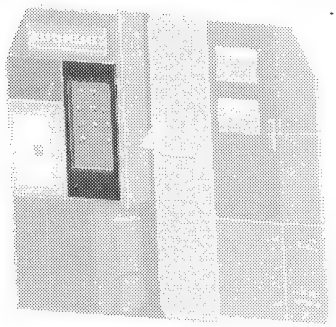


Figure B-35: Switch panel, Cab F rear wall (CRWPF)

Notes, item 9: Battery Contactor Switch {125}

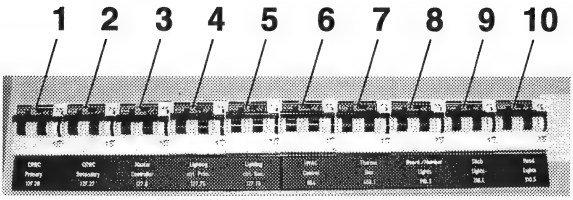
This switch allows you to switch on / shut down the locomotive by connecting / disconnecting the main loads including the whole control electronics to / from the battery. This switch also allows you to switch on the locomotive for another 60 minutes after a controlled shutdown due to battery charger failure.

Notes, item 10: Machine Room Lights Push Button {327}

This switches the machine room lights ON/OFF.

If the Battery Contactor Switch {125} (on CRWPF) is OFF, the machine room lights are timer controlled. The lights will then go off automatically after 30 minutes.

4.4.2 Local circuit breaker panel (CRWC1)



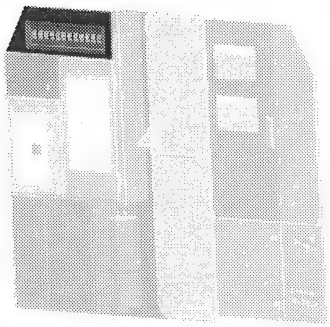


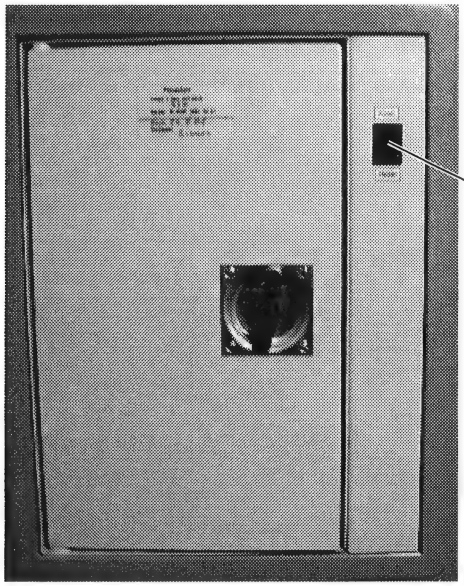
Figure B-36: Local DC circuit breakers (CRWC1)

Circuit Breakers on Panel CRWC1 in Cab F control the 72 VDC supply to the following equipment in Cab F:

EDITION C: 2003. SEP. 15

#	CB	Protects
1	CRWC Primary {127.26}	Rear Wall Primary Bus
2	CRWC Secondary {127.27}	Rear Wall Secondary Bus
3	Master Controller {127.6}	Power supply to Throttle/Reverser
4	Lighting ctrl. Prim. {127.75}	IDU, Alerter, Horn, Bell, Sanding, Cab Heater Control (Primary Bus)
5	Lighting ctrl. Sec. {127.76}	Alerter, Bell, Headlight (Secondary Bus)
6	HVAC Control {864}	HVAC Control
7	Thermo Box {463.1}	Thermo Box
8	Board./Number Lights {310.3}	Step Lights, Number Lights
9	Ditch Lights {310.4}	Ditch/Crossing Lights
10	Head Lights {310.5}	Head Lights

4.4.3 Thermo box



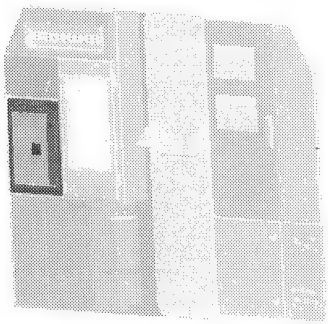


Figure B-37: Thermo box {481} Cab F, {482} Cab B

#	Description	Notes
1	Switch Thermo Box	Cooling - Off - Heating

Notes, item 1: Thermo box

The thermo box is used to keep items such as food or beverages for the engineer either warm (heating function) or cold (cooling function), according to the setting of the switch.

4.4.4 Box for fusees & torpedoes

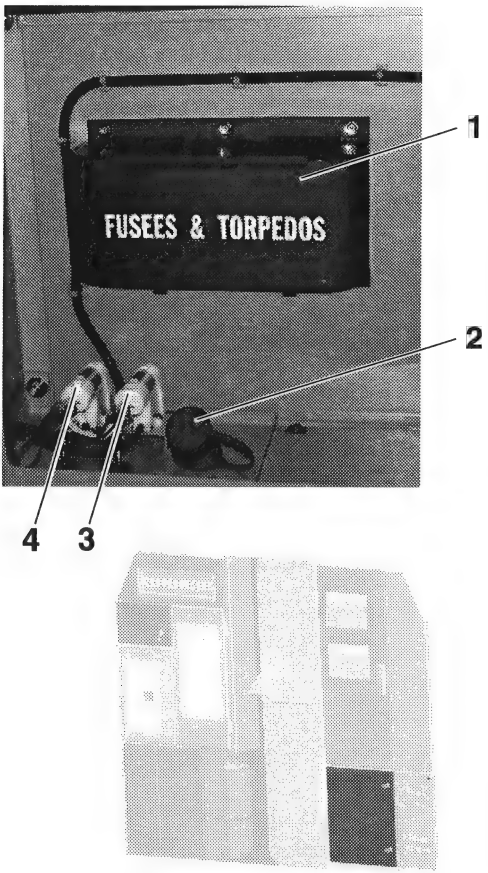


Figure B-38: Box for fusees & torpedoes

#	Description
1	Box used to store fusees & torpedoes etc.
2	Filling plug for windshield washer reservoir
3	Pump for windshield washer, engineer side {288.5}
4	Pump for windshield washer, fireman side {266.6}

Notes, item 1: Box for fusees & torpedoes

Fusees and torpedoes are incendiary devices which can be used for traffic warning in case of an emergency.

Notes, item 2: Filling plug for windshield washer reservoir

Fill the water reservoir with normal water. Non-aggressive detergents may be added.

Do not overfill the reservoir. Wipe off any extra liquid.

Note!

Only use clean water; add antifreeze liquid if necessary.

4.4.5 Alarm panel (CRWC5)

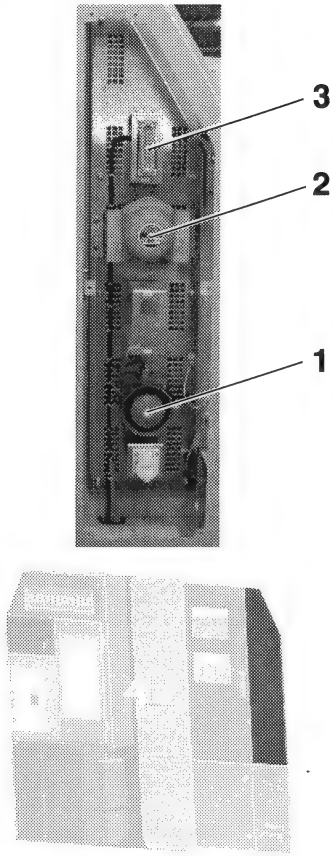


Figure B-39: Alarm panel

#	Description
1	Fire Alarm Siren {238.1}
2	Alarm Bell {165.1}
3	Traction converter service connectors {376.1} and {376.2}

EDITION C: 2003. SEP. 15

The following components are located behind the alarm panel cover:

- Alarm Bell {165.1}
- Fire Alarm Siren {238.1}
- Traction Converter service connectors {376.1} and {376.2}

Notes, item 1: Fire Alarm Siren

The Fire Alarm Siren will be activated when the smoke detectors sense heavy smoke in the machine room.

Notes, item 2: Alarm Bell

The alarm bell will be activated under fault conditions which are categorized as alarms (more serious faults that can affect the performance of the locomotive).

Notes, item 3: Traction Converter service connectors

The traction converter service connectors are used for special measurements of internal traction converter signals (Cab F only).

4.4.6 Wardrobe / emergency cellphone

Inside each wardrobe there is a handset for the emergency cellphone which can be used for communication in case of emergency.

The cellphone in Cab F is always in service unless Cab B is made up.

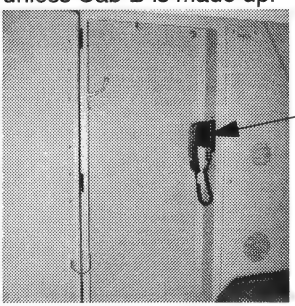


Figure B-40: Wardrobe with Emergency CellPhone Handset

4.5 Switch panel - Cab B rear wall (CRWPB)

The Rear Wall Switch Panel (CRWP) of Cab B has fewer switches than the Cab F CRWP panel.

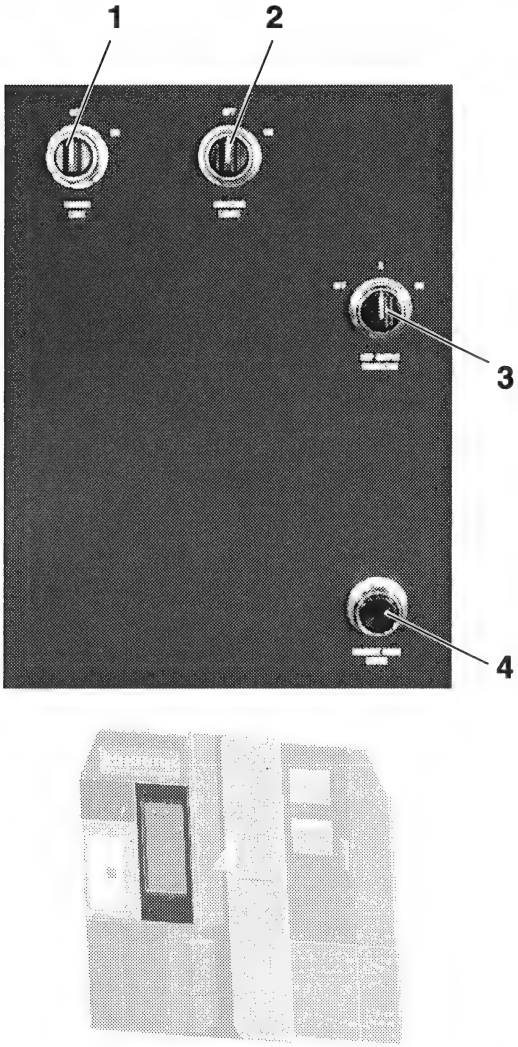


Figure B-41: Switch panel, Cab B rear wall (CRWPB)

#	Description
1	Number Light Switch {316.6}
2	Boarding Lights Switch {316.4}
3	HEP Output Contactor Release Switch {32.11}
4	Machine Room Lights Push Button {327}

Notes, item 1: Number Light Switch {316.6}

This number light switch controls the locomotive identification light on the Cab B end.

Notes, item 2: Boarding Lights Switch {316.4}

This boarding light switch controls the step/boarding lights on the Cab B end.

Notes, item 3: HEP Output Contactor Release Switch {32.11}

This item is for releasing the 480V power to the HEP TL (trainline). The HEP output contactor cannot close until this switch is set to ON position. This switch is spring-loaded and returns to the neutral position in the middle after being operated by hand. The actual state of the HEP output contactor is visible on the Indication Light Panel CSP3 on the side wall of the cab.

Notes, item 4: Machine Room Lights Push Button {327}

This item switches the machine room lights ON/OFF.

If the Battery Contactor Switch {125} (on CRWPF) is OFF, the machine room lights are timer controlled. The lights will then go off automatically after 30 minutes.

4.6 Operating elements in the cab

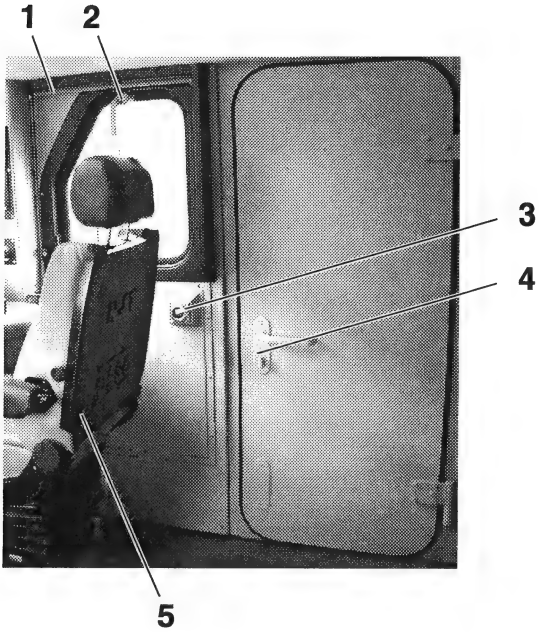


Figure B-42: Cab side wall

#	Description
1	Blind
2	Side window
3	Cab light push button
4	Lock for cab door
5	Engineer's seat

EDITION C: 2003. SEP. 15

Notes, item 1: Blind

Pull the blind down with the black grip until the required height has been reached. The blind will remain at the chosen height after releasing the grip.

To raise the blind pull the cord.**Notes, item** 2: Side window

To unlock the side window mechanism, press the red button and turn the lever to the right.

The lever can now be used to slide down the window.

To lock the window, slide it up and turn the lever to the left until the red button locks in place.

Notes, item 3: Cab Light Push Buttons engineer side {324.11} and fireman side {324.12}

These push buttons operate the cab light. The cab light also can be operated by the non-latching toggle switch {324} on the left switch panel (CDPL) on the engineer's desk.

If the Battery Contactor Switch {125} (on CRWPF) is OFF, the cab light is timer controlled. The light will then go off automatically after 30 minutes.

Notes, item 4: Lock for cab door

The cab door is locked and unlocked from the inside by operating a lever and from the outside using a key.

Notes, item 4: Engineer's seat

See "Engineer's seat" on page 136.

4.6.1 Engineer's seat

Figure B-43: Engineer's seat

Notes, item 1:

Press the lever to adjust the head rest

Notes, item 2:

Adjusting the lumbar support:

- Adjusting forwards: turn to the left
- Adjusting backwards: turn to the right

Notes, item 3:

Adjusting the inclination of the arm rest

- To lower the arm rest: turn to the left
- To raise the arm rest: turn to the right

Notes, item 4:

Adjusting the angle of the back rest

- Towards the front: turn to the left
- Towards the rear: turn to the right

Notes, item 5:

Adjusting the angle of the seat

- To lower the front of the seat: turn to the left
- To raise the front of the seat: turn to the right

Figure B-44: Engineer's seat

Notes, item 6:

Adjusting the seat height

- To raise: turn to the left
- To lower: turn to the right

Notes, item 7:

Rotating the seat

- Turn upwards: the seat can be rotated to any angle
- Turn downwards: the seat locks in place in 90° steps

Notes, item 8:

Sliding the seat

- Turn upwards: the seat can be slid forwards or backwards
- Turn downwards: the seat locks in place

4.7 Machine room

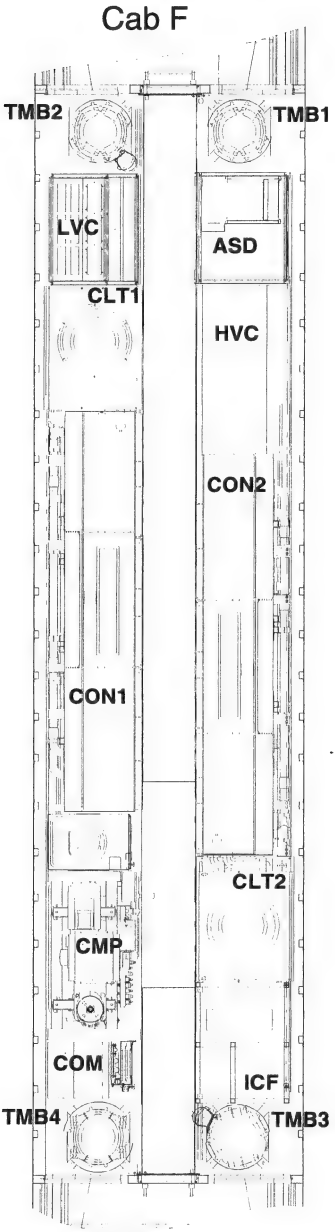


Figure B-45: Overview of the machine room

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4.7.1 Safety keys in the machine room

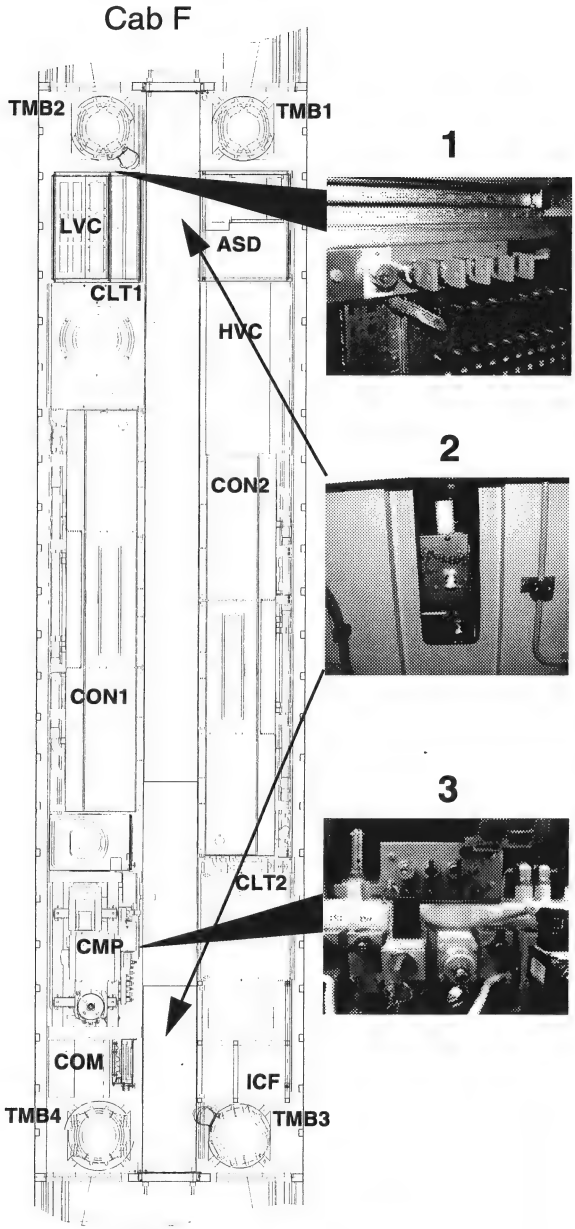

Figure B-46: Safety keys in the machine room

EDITION C: 2003. SEP. 15

Notes, item 1:

Key Multiplier 2

Notes, item 2:

Pantograph grounding and lock down claws (located in the roof)

Notes, item 3:

Pantograph valve and key multiplier 1

Grounding of the locomotive and the associated safety key concept is described in "Grounding the locomotive" on page 52.

4.7.2 Checking the fluid levels

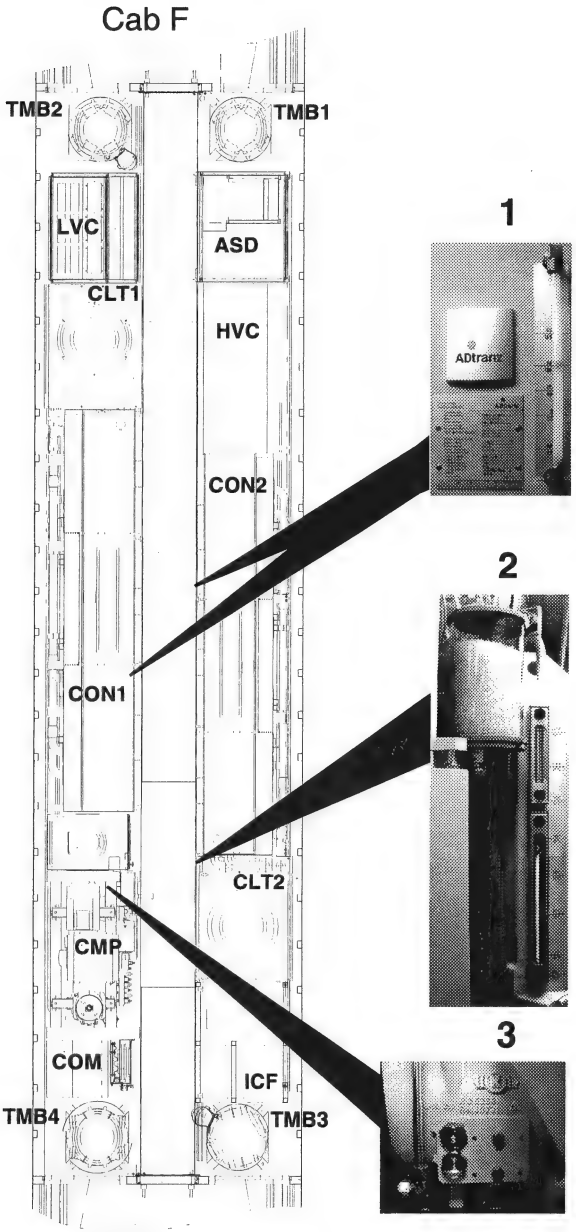

Figure B-47: Checking points for fluid levels

Notes, item 1:

Level indicator for the traction converters 1 and 2 coolant

Notes, item 2:

Level indicator for transformer coolant

Notes, item 3:

Level indicator for compressor oil

4.7.3 Circuit breakers

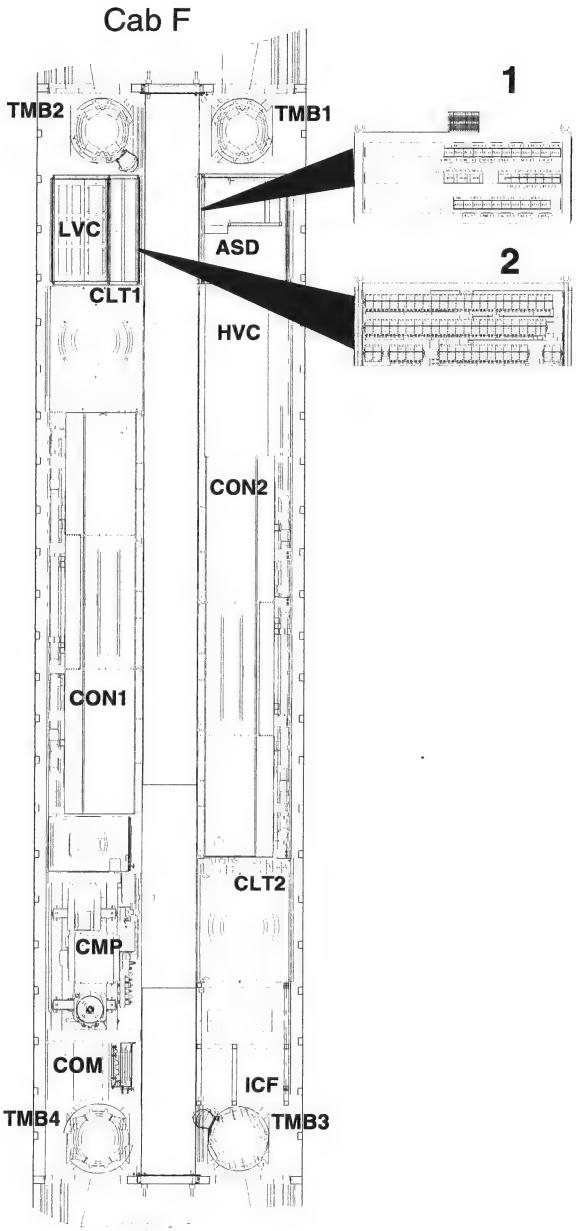

Figure B-48: Circuit breakers in the machine room

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Notes, item 1:

Circuit breaker Panel ASD

Notes, item 2:

Circuit breaker Panel LVC

Circuit breaker panel ASD

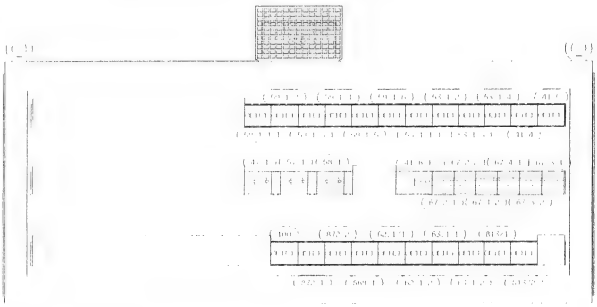

Figure B-49: Circuit breaker panel ASD

#	CB	Protects
Top row (from left to right)		
59.1/1	Fan Converter 1	
59.1/2	Fan Converter 1	
59.1/3	Fan Converter 1	
59.1/4	Fan Converter 2	
59.1/5	Fan Converter 2	
59.1/6	Fan Converter 2	
53.1/1	TMB 1	Traction Motor Blower 1
53.1/2	TMB 2	Traction Motor Blower 2
53.1/3	TMB 3	Traction Motor Blower 3
53.1/4	TMB 4	Traction Motor Blower 4
41.4	Wayside Power Contr.	control voltage for wayside power contactor {52.3}
41.5	Feed Dead Loco Contr.	Control voltage for feeding dead loco contactor {52.6}
Middle row (from left to right)		
47.1	Main Air Compressor	Main Air Compressor
57.1	Fan CLT 1	Fan Cooling Tower 1
58.1	Fan CLT 2	Fan Cooling Tower 2

#	CB	Protects
41.6	GFI 110 V Receptacle	110V AC receptacles
67.2/1	Heater Fans Cab F	Fans in additional cab heaters in rear wall F
67.2/2	Heater Fans Cab B	Fans in additional cab heaters in rear wall B
67.4/2	WS.Heat.Frm Cab B	Windshield Heating Fireman Side Cab B
67.4/1	WS.Heat.Frm Cab F	Windshield Heating Fireman Side Cab F
67.3/2	WS.Heat.Eng Cab B	Windshield Heating Engineer Side Cab B
67.3/1	WS.Heat.Eng Cab F	Windshield Heating Engineer Side Cab F
Bottom row (from left to right)		
100	Battery Charger	
872/1	HVAC Unit Cab F	
872/2	HVAC Unit Cab B	
868.1	Transformer	Transformer {867} for Cab Heater Fans and 110V AC Receptacles
62.1/1	Trafo Coolant Pump 1	Coolant Pump 1 for transformer
62.1/2	Trafo Coolant Pump 2	Coolant Pump 2 for transformer
63.1/1	Con. Coolant Pump 1	Coolant Pump 1 for converter
63.1/2	Con. Coolant Pump 2	Coolant Pump 2 for converter
813/1	Heater Cab F	Heating in additional Cab Heaters Cab F
813/2	Heater Cab B	Heating in additional Cab Heaters Cab B

EDITION C: 2003. SEP. 15

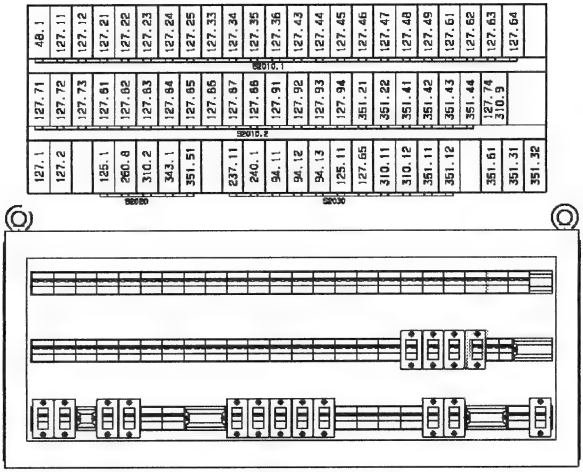

Figure B-50: Circuit breaker panel LVC

#	CB	Protects
Top row (from left to right)		
48.1	Auxiliary Compressor	Auxiliary Compressor
127.11	CRWC Cab B	Cab Rear wall Cabinet Cab B
127.12	CRWC Cab F	Cab Rear wall Cabinet Cab F
127.21	ASD Primary	Cubicle ASD, Primary Bus
127.22	ASD Secondary	Cubicle ASD, Secondary Bus
127.23	LVC Primary	Cubicle LVC, Primary Bus
127.24	LVC Secondary	Cubicle LVC, Secondary Bus
127.25	LVC Independent	Cubicle LVC, Independent segment
127.33	COM Primary	Cubicle COM, Primary Bus
127.34	COM Secondary	Cubicle COM, Secondary Bus
127.35	VTCU & Star Coupler Primary	VTCU & Star Coupler Primary
127.36	VTCU & Star Coupler Secondary	VTCU & Star Coupler Secondary
127.43	ICF Primary	Cubicle ICF, Primary Bus

#	CB	Protects
127.44	ICF Secondary	Cubicle ICF, Secondary Bus
127.45	Contactor ICF Prim.	Contactor ICF primary
127.46	Contactor ICF Sec.	Contactor ICF secondary
127.47	HVC Primary	Cubicle HVC, Primary Bus
127.48	HVC Secondary	Cubicle HVC, Secondary Bus
127.49	Contactors HVC	Contactors HVC
127.61	Conv. 24V Cab F Prim.	24 V DC/DC Converter Cab F, Primary Bus
127.62	Conv. 24V Cab F Sec.	24 V DC/DC Converter Cab F, Secondary Bus
127.63	Conv. 24V Cab B Prim.	24 V DC/DC Converter Cab B, Primary Bus
127.64	Conv. 24V Cab B Sec.	24 V DC/DC Converter Cab B, Secondary Bus
Middle row (from left to right)		
127.71	Air Cubicle Prim.	Cubicle CMP, Primary Bus
127.72	Air Cubicle Sec.	Cubicle CMP, Secondary Bus
127.73	Air Dryer	Air Dryer
127.81	Conv. 1 (12NX01)	Control voltage Traction Converter 1 (Module 12NX01)
127.82	Conv. 1 (GUSP)	Control voltage Traction Converter 1 (Gate Unite supply)
127.83	HEP Conv. (12NX01)	Control voltage HEP Converter (Module 12NX01)
127.84	HEP Conv. (GUSP)	Control voltage HEP Converter (Gate Unite supply)
127.85	Conv. 2 (12NX01)	Control voltage Traction Converter 2 (Module 12NX01)
127.86	Conv. 2 (GUSP)	Control voltage Traction Converter 2 (Gate Unite supply)
127.87	AUX Conv. (12NX01)	Control voltage AUX Converter (Module 12NX01)
127.88	AUX Conv. (GUSP)	Control voltage AUX Converter (Gate Unite supply)
127.91	CE Conv. 1 / HEP	Control electronics Converter 1 / HEP inverter
127.92	CE Conv. 2 / AUX	Control electronics Converter 2 / AUX inverter

#	CB	Protects
127.93	Contactors CON 1	Control voltage contactors CON 1 / HEP converter
127.94	Contactors CON 2	Control voltage contactors CON 2 / AUX converter
351.21	Supply TL 13T/4T	Supply for trainline 13T/4T
351.22	Trainline Box	Power supply Trainline Box
351.41	Dynamic Tag	Power supply for Dynamic Tag
351.42	RDS Mobile Station	Power supply for Remote Diagnostic System
351.43	CDPD Air Booster	Air Booster
351.44	Car Comm.	Power supply for Car Communication System
127.74	Panto Air Supply	Power supply (independent) for Panto air supply
310.9	H Light TL	Headlight powered via Trainline
Bottom row (from left to right)		
127.1	Lasting Loads	all lasting load circuits (marked with red color)
127.2	Essential Loads	all essential load circuits (marked with blue color)
125.1	Battery Control	Control voltage for battery control circuits
260.8	EPIC Brake Contr.	Power supply EPIC brake equipment
310.2	Lighting MR & Cabs	Power supply for lighting in machine room and cabs
343.1	Receptacle 74VDC	Commissioning receptacle 74VDC in rear wall Cab F
351.51	Emerg. Cell Phone	Power supply for Emergency Cell Phone
237.11	Alerter Function	Control voltage for Alerter
240.1	ATC	Power supply for ATC system
94.11	Event Data Recorder	Power supply for Event Data Recorder
94.12	Fault Event Rec QFER	Power supply for Quantum Fault Event Recorder (QFER)
94.13	Cell. Download Mod.	Power supply for Cellular Download Module
125.11	Battery Charger	Control voltage for battery charger
127.65	Conv. 24V ASD	74/24VDC Converter ASD

#	CB	Protects
310.11	Marker Light Cab B	Marker Lights Cab B
310.12	Marker Light Cab F	Marker Lights Cab F
351.11	Radio Cab B	Radio Cab B
351.12	Radio Cab F	Radio Cab F
351.61	DTN Connection	Connection between DTN and Trainlines (fed by Trainline)
351.31	Door Control	Control voltage for door control (fed by Trainline)
351.32	Brake System	Control voltage for battery brake system (fed by Trainline)

EDITION C: 2003. SEP. 15

4.7.4 Switch panels on LVC, ASD, COM and CMP

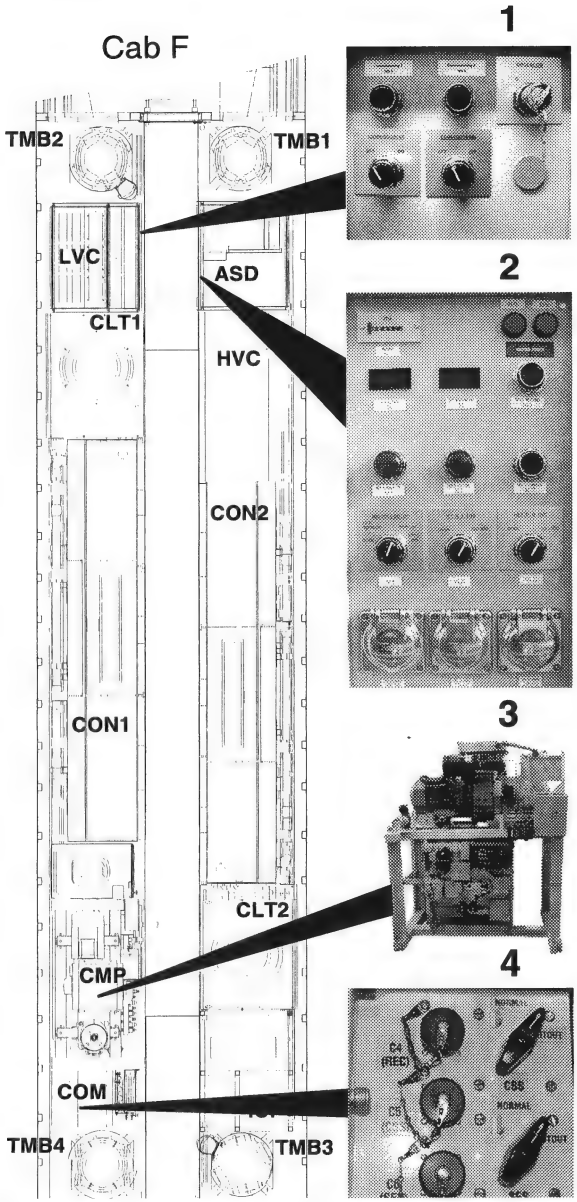

Figure B-51: Switch panels in the machine room

Notes, item 1:

Switch Panel LVC

Notes, item 2:

Switch Panel ASD

Notes, item 3:

Switch Panel CMP

Notes, item 4:

Switch Panel COM

Switch Panel LVC

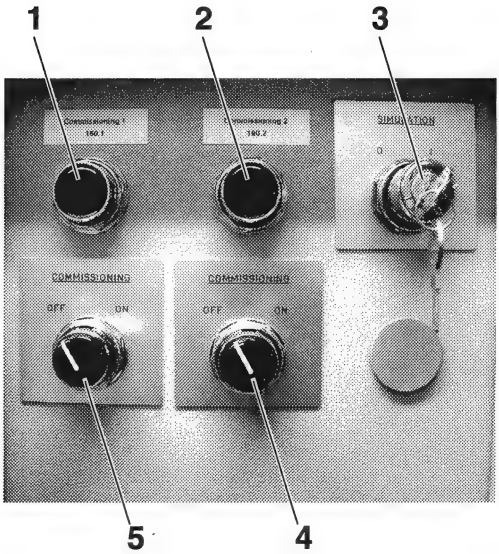

Figure B-52: Switch panel LVC

#	Description
1	Push Button Commissioning 1 {160.1}
2	Push Button Commissioning 2 {160.2}
3	Key Switch Simulation {179}
4	Switch Commissioning {161.1}
5	Switch Commissioning {161.2}

Notes, items 1 and 2: Push Button Commissioning {160.1} and {160.2}

These push buttons are only used for special functions during commissioning or service.

Notes, item 3: Key Switch Simulation {179}

The simulation key switch is only used during maintenance. It allows to go through the start-up sequence of the locomotive without catenary voltage and thus to test the equipment for correct operation before applying the main power. The simulation key switch should be removed during normal locomotive service.

Warning!

Operation of this switch is only allowed for testing or maintenance purposes! Locomotive operation may become faulty if simulation mode is enabled during normal locomotive service!

Notes, items 4 and 5: Switch Commissioning {161.1} and {161.2}

These switches are only used for special functions during commissioning or service.

Switch panel ASD

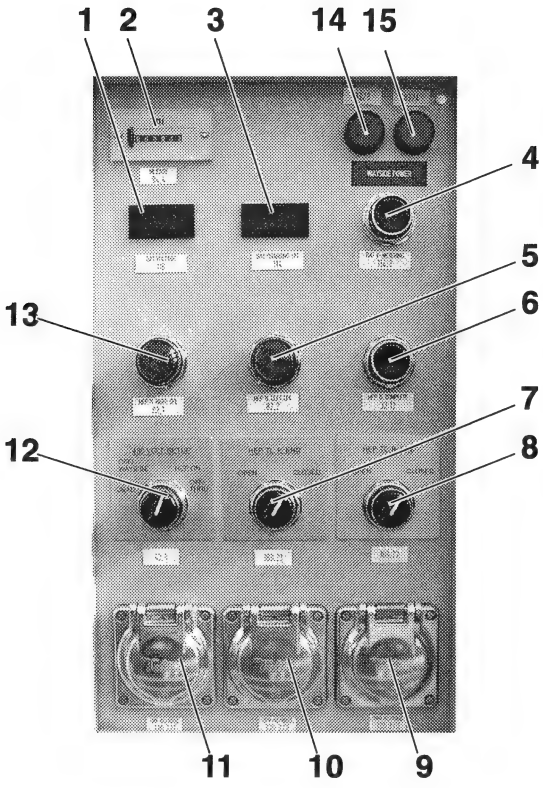

Figure B-53: Switch panel ASD

EDITION C: 2003. SEP. 15

#	Description
1	Voltmeter 'BAT Voltage' (V) {116}
2	Mileage Counter'
3	Ammeter 'BAT Charging Current' (A) {114}
4	Push Button 'BAT V-Metering' {114.3}
5	Indication Lamp 'HEP TL left cpl.' {82.2}
6	Push Button 'HEP TL Compl.' {32.12}
7	Configuration Switch 'HEP TL F-End' {169.21} OPEN - CLOSED
8	Configuration Switch 'HEP TL B-End' {169.22}OPEN - CLOSED
9	Receptacle 110 V AC / 60Hz {335.2/3}
10	Receptacle 110 V AC / 60Hz {335.2/2}
11	Receptacle 110 V AC / 60Hz {335.2/1}
12	Configuration Switch 'Wayside / HEP' {42.6} DEAD - OFF/WAYSIDE HEP ON OFF/THRU
13	Indication Lamp 'HEP TL right cpl.' {82.1}
14	Indication Wayside Power Voltage {83/1}
15	Indication Wayside Power Voltage {83/3}

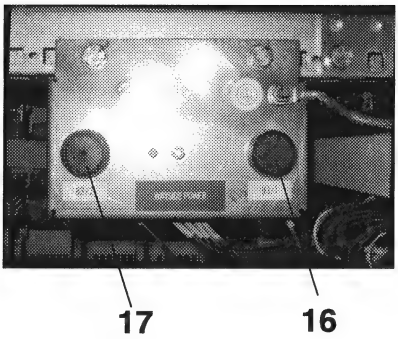

Figure B-54: Indication Panel Wayside Power Voltage (inside ASD)

#	Description
16	Indication Wayside Power Voltage {83/2}
17	Indication Wayside Power Voltage {83/4}

High Voltage! Mortal Danger!

Do not open the ASD as long as any of the four indication lamps "Wayside Power Voltage" {83/1 ... 83/4} on the ASD switch panel and inside the ASD is lighting!
In this case there are 480 V in the cubicle resp. some parts are living due to coupled wayside power receptacle although the locomotive is shut down or dead!

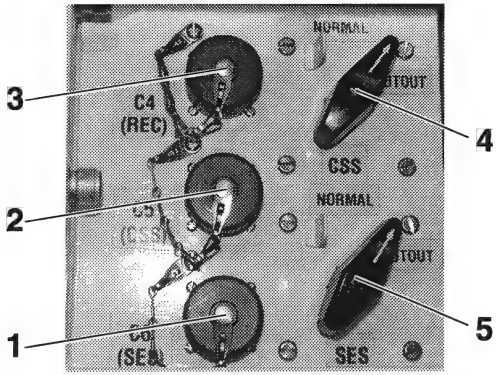

Figure B-55: Switch panel on Communication cubicle (COM)

The following connectors and switches are located on the ASES Main Unit:

#	Description
1	Service connector C6 for SES
2	Service connector C5 for CSS
3	Service connector C4 for REC
4	CSS Cutout Switch {240.CSS}
5	SES Cutout Switch {240.SES}

The communication cubicle basically contains the following components:

- ATC Central Unit (ASES), including FRA Event Recorder
- Fault Event Recorder
- Vehicle Control Electronics Main Units

Notes, item 1, 2 and 3: ATC Service connectors

These connectors are only used for special measurements or ATC Software data up-/download.

Notes, item 4: CSS Cutout Switch {240.CSS}

This switch cuts out the CSS function of the ASES.

When the CSS is cut out, follow NJTransit operating rules on continuing operation of the locomotive.

Notes, item 5: SES Cutout Switch {240.SES}

This switch cuts out the SES function of the ASES.

When the SES is cut out, follow NJTransit operating rules on continuing operation of the locomotive.

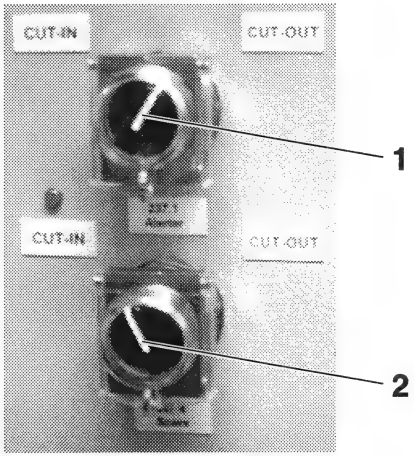

Figure B-56: Switch panel on Communication cubicle (COM)

The following controls are located on the front door of the COM Cubicle:

#	Description
1	Alerter Cutout Switch {237.1}
2	Sealable Cutout Switch (spare) {247.4}

Notes, item 1: Alerter Cutout Switch {237.1}

This switch cuts out the Alerter.

When the Alerter is cut out, follow NJTransit operating rules on continuing operation of the locomotive.

Notes, item 2: Sealable Cutout Switch (spare) {247.4}

This switch is currently not used.

Switch panel on Communication Cubicle (COM), ctd.

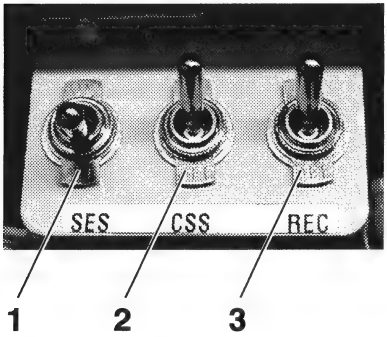

Figure B-57: Switch panel on Communication cubicle (COM)

The following controls are located behind the front door of the ASES Main Unit:

#	Description
1	SES: Battery power switch for SES
2	CSS: Battery power switch for CSS
3	REC: Battery power switch for the recorder

Notes, items 1, 2 and 3:

These switches should only be operated by the maintenance personnel.

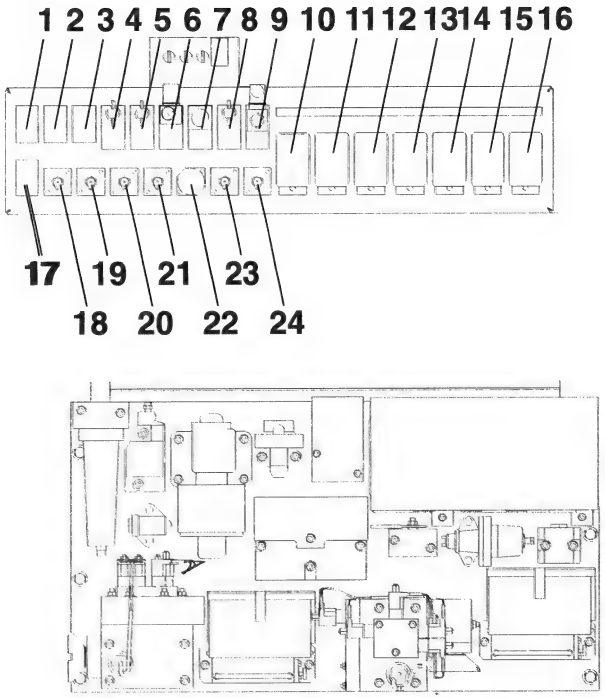

Figure B-58: Compressed air cubicle (CMP)

#	Description
1	Filter Aux. Comp. Air [43]
2	Check Valve Main Reservoir [28/2]
3	Check Valve Aux. Reservoir [28/1]
4	Cutout Cock Aux. Reservoir [29.2]
5	Cutout Cock Pantograph & MCB Supply [29/1]
6	Cutout Cock Pantograph & MCB Air {129.6}, [95]
7	Reducing Valve Cleaning Block Press. [48]
8	Cutout Cock Cleaning Block Brake [29/3]
9	Magnet Valve Cleaning Block Brake {282}, [37]
10	Pressure Switch Bell Pressure {187.8}, [52/3]
11	Pressure Switch Brake Pipe Pressure {269}, [47]
12	Pressure Switch Aux. Comp. Control {136.1}, [78]
13	Pressure Switch Main Comp. Control {173.1}, [50]
14	Pressure Switch Low Main Res. Press. {173.2}, [51]
15	Pressure Switch Pantograph & MCB Press. {129.4}, [55]
16	Pressure Switch Brake Cylinder Press. {286}, [53]
17	Double Check Valve Aux. Comp. - Main Res. [32]
18	Test Point Bell Pressure [45/4]
19	Test Point Brake Pipe Pressure [45/5]
20	Test Point Main Res. Press. [45/6]
21	Test Point Pantograph & MCB Press. [45/7]
22	Pressure Gauge Pantograph & MCB Air [44/1]
23	Test Point Brake Cylinder Press. [45/3]
24	Test Point Cleaning Block Press. [45/8]

Note: Numbers within [] refer to items in pneumatic diagrams and numbers within {} refer to items in electrical wiring diagrams.

EDITION C: 2003. SEP. 15

4.7.5 Remote diagnostic system RDS (RRDP)

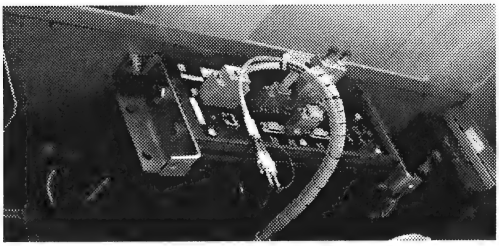

Figure B-59: Remote Diagnostic System RDS

#	Description
1	Roof Remote Diagnostic Panel (RRDP)

Notes, item 1: Roof Remote Diagnostic Panel

The Remote Diagnostic System (RDS) is located on the Roof Remote Diagnostic Panel (RRDP), which is mounted on the middle roof section above traction converter No. 1.

The RDS provides diagnostic data transmission to the maintenance center whenever the locomotive is in layover near to a RDS ground station. The maintenance group can retrieve the data in advance, so that the necessary repair/maintenance work can be prepared before the locomotive reaches the workshop.

4.7.6 Toilet

Figure B-60: Toilet

#	Description
1	Flushing lever

EDITION C: 2003. SEP. 15

4.8 Operating elements / indicators outside of the loco

4.8.1 Indicator lights

ATC on and hand brake not fully released

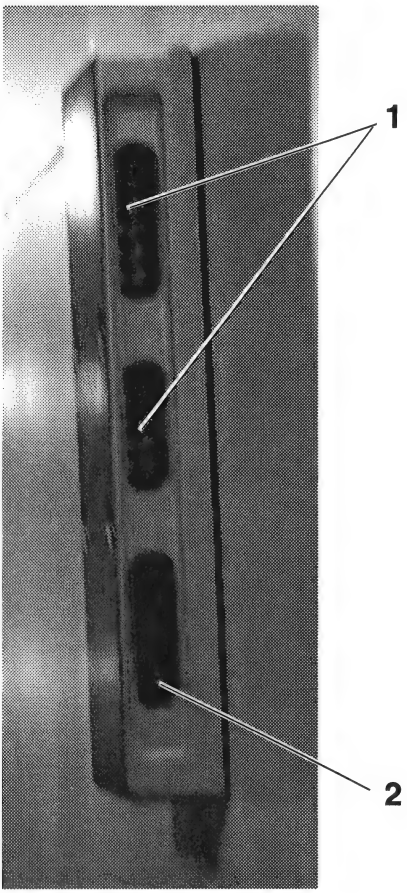

Figure B-61: Indicator lights ATC On and Hand Brake Not Fully Released {318.5}

#	Description
1	Indicator Light ATC On
2	Indicator Light Hand Brake Not Fully Released

ATC ON/OFF and Hand Brake Not Fully Released Indicators

There are two ATC/Hand Brake Not Fully Released Indicators behind the cab doors on the outside of the locomotive, one each on the right side of the F end and the B end. Each of them has three LED indicators in a vertical arrangement that show the status as follows:

The two upper white indicators are lit when ATC is in effect, i.e. ATC cut in and Territory Coded.

The bottom blue indicator is lit when the locomotive hand brake is not fully released.

These indicators are visible from the outside of the locomotive and also to the engineer when looking into the rear view mirror.

4.8.2 Air dryer bypass cock

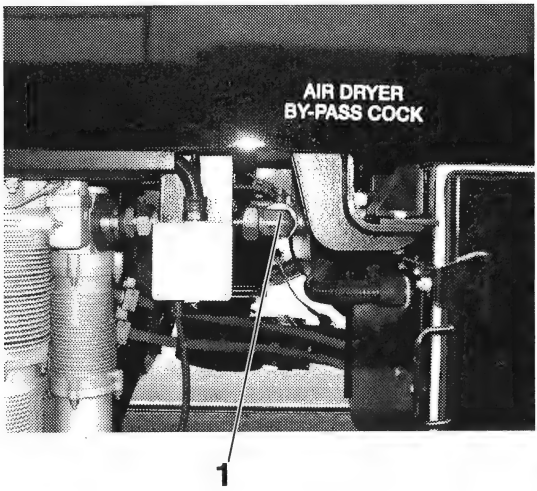

Figure B-62: Air dryer bypass cock

#	Description
1	Air Dryer Bypass Cock

The Air Dryer Bypass Cock is used to bypass the air drying equipment in case of faults.

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EDITION C: 2003. SEP. 15

4.8.3 Center buffer coupler

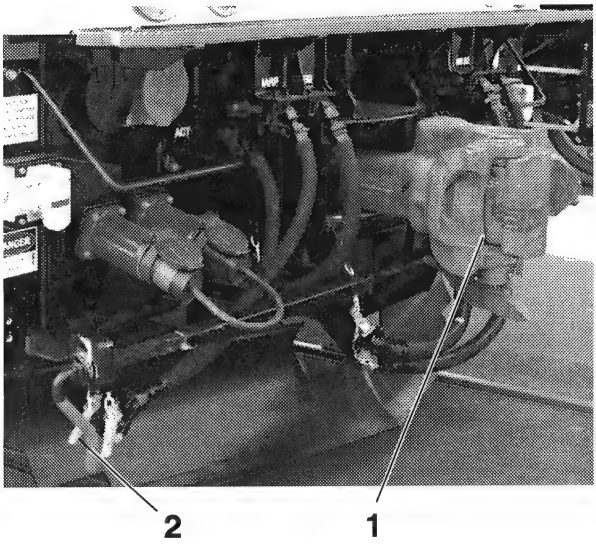


Figure B-63: Center buffer coupler

#	Description
1	Center buffer coupler
2	Operating lever, center buffer coupler

Notes, item 2: Operating lever, center buffer coupler

First raise the operating lever to the "Coupler latched" position (vertical) to ensure that it will correctly go into the locked position.

4.8.4 Coupler, cable and hose end connections

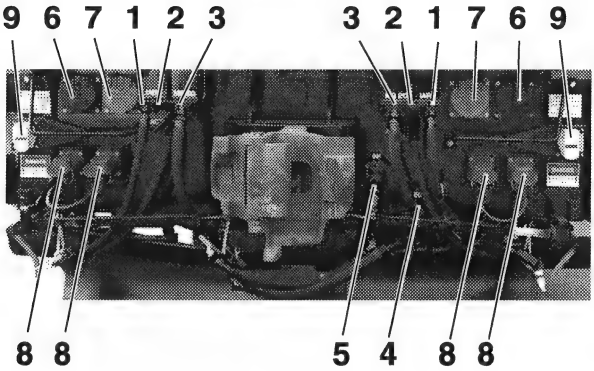


Figure B-64: Coupler, cables and hose end connections

#	Description
1	Independent Application & Release (IARP)
2	Actuating Pipe (ACT)
3	Main Reservoir Equalizing Pipe (MR EQ)
4	Main Reservoir Equalizing Pipe (MR EQ)
5	Brake Pipe (BP)
6	Locomotive control receptacle (trainline)
7	Communication/Brake/Door receptacle
8	HEP receptacle
9	DTN receptacle

EDITION C: 2003. SEP. 15

4.8.5 Brake indicators

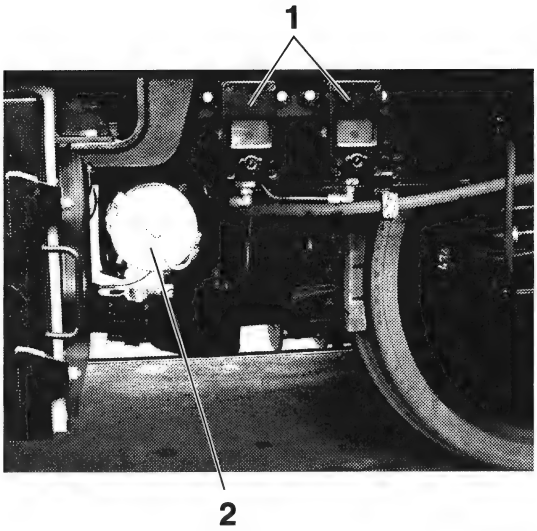


Figure B-65: Brake indicators

#	Description
1	Brake indicators
2	Drain coupling, sewage tank

Notes, item 1: Indicator red: Brake applied; Indicator green: Brake not applied (BC pressure 0 psi).

5 Using the intelligent display unit (IDU)

5.1 General

Each engineer's desk is provided with a color display (also called Intelligent Display Unit, IDU) which provides information on the locomotive status to the driving engineer and maintenance personnel.

The information shown mainly consists of operating and diagnostics data and online instructions to help the engineer to remedy any faults which have been detected.

The operating and diagnostics functions of the IDU include:

- display of operating data and process values
- display of fault and status messages and online instructions for the driving engineer
- diagnostics functions for maintenance personnel
- display and entry of train parameters and train number for the Automatic Train Control (ATC) system

The display electronics is also provided with non-volatile memory. This is used to store information on operator actions and fault messages in situations where permanent records are obligatory.

Note!

The computer takes about 3 minutes to boot after switching it on. During this time the display shows internal status messages. Do not operate any of the operating elements until the main screen appears.

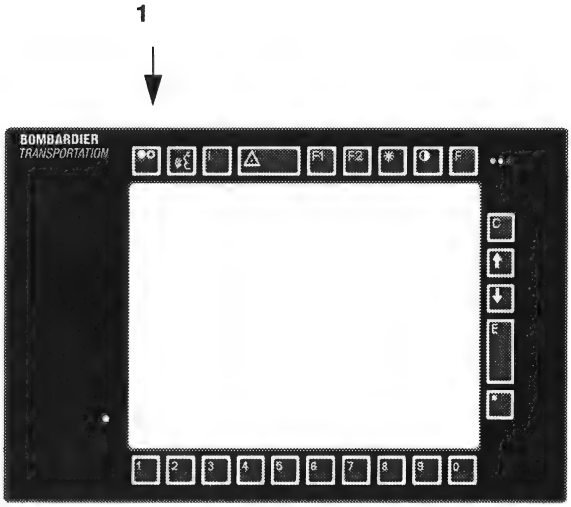


Figure B-66: Intelligent Display Unit (IDU)

See Table B-1 on page 181 for descriptions of all of the buttons on the IDU.

EDITION C: 2003. SEP. 15

5.1.1 Switching ON the IDU

Press the "ON/OFF" key to display the main menu (Figure B-66 on page 176, item 1).

5.1.2 Switching OFF the IDU

Press the "ON/OFF" key again to switch off the IDU (Figure B-66 on page 176, item 1).

The IDU is also switched off when the engineer's desk is switched off. Or when Reverser is replaced ~~removed~~ in Isolate

5.2 IDU operating elements

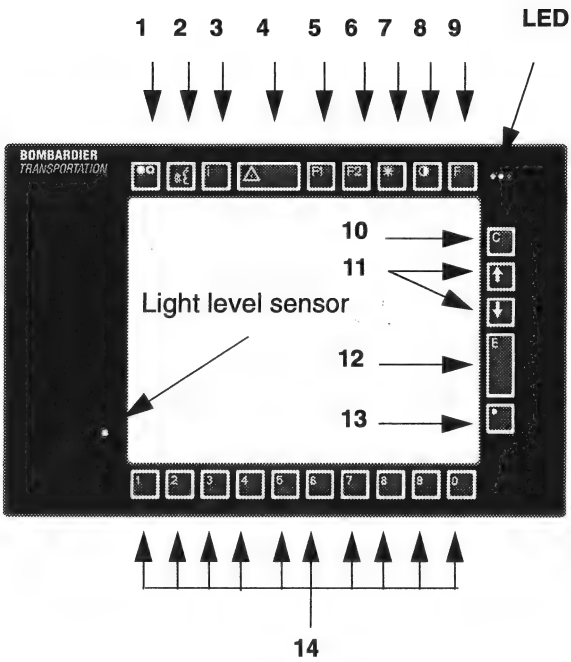


Figure B-67: Intelligent Display Unit (IDU)

See Table B-1 on page 181 for descriptions of all of the buttons on the IDU.

Note!

It is recommended to test all of the control functions provided by the IDU in order to get to know all of the menus.

The IDU is operated using the buttons (keys) which are built into the front panel.

Two types of keys are provided:

- Keys which are permanently assigned (hardkeys)
  (numbers 1 to 13 in Figure B-67 on page 178).
- Keys whose assignment depends on the selected menu (softkeys)
  (number 14 in Figure B-67 on page 178).

The keyboard has a total of 24 keys, whereby 14 of them are hardkeys and 10 of them are softkeys.

5.3 Overview of the IDU keys

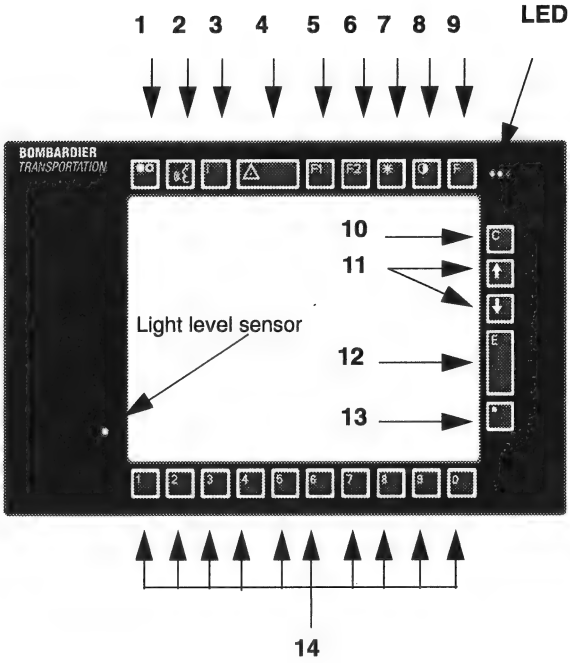


Figure B-68: Intelligent Display Unit (IDU)

#	Key	Function
1		Switches the display on and off.
2		Language slection key
3		The INFO key shows the information message screen
4		FAULT not used
5		(Reserved for special functions) Loco Alarms
6		(Reserved for special functions) Train Alarms
7		Used to change the brightness of the display (menu controlled)
8		Day / Night Toggles the screen
9		The FUNCTION key is a function shift key for double functions.

Table B-1: Functions of the IDU keys

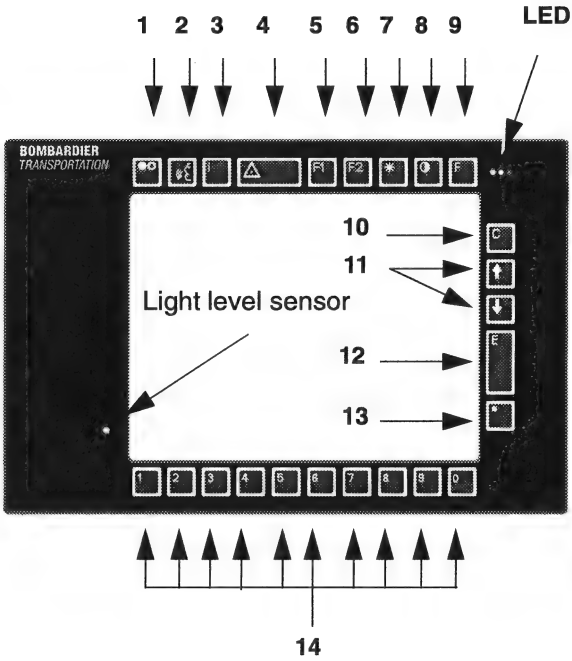


Figure B-69: Intelligent Display Unit (IDU)

#	Key	Function
10		The CLEAR key goes back to the screen one level up in the menu structure.
11		These two keys are used as cursor keys in a number of the screens.

Table B-2: Functions of the IDU keys (ctd.)

#	Key	Function
12		ENTER to confirm and acknowledge operator actions.
13		The POINT key. Used as a function shift key for special double functions.
14		softkeys (1, 2,.....0) depends on the selected menu and is shown on the display adjacent to each key. Note: The display is not a touch-screen.

Table B-2: Functions of the IDU keys (ctd.)

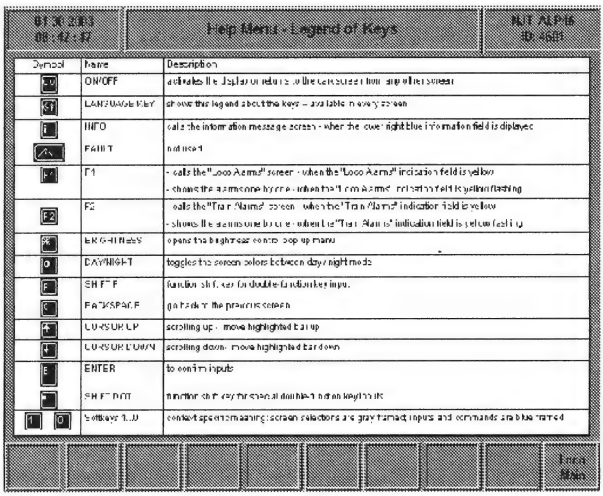
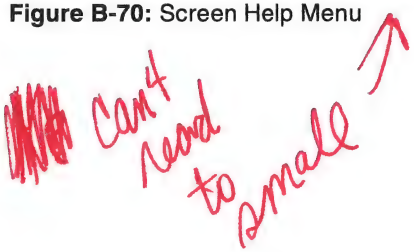


Figure B-70: Screen Help Menu



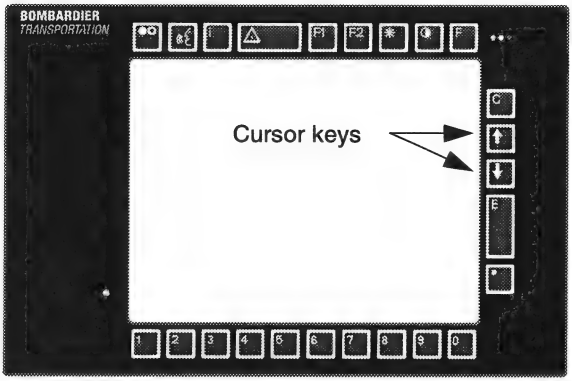


Figure B-71: Intelligent Display Unit (IDU)

Cursor keys

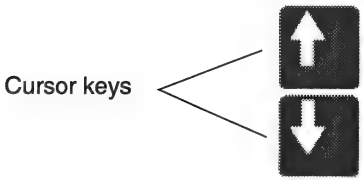


Figure B-72: Cursor keys

The cursor keys '⇧' and '⇩' on the right edge of the display are used to select the required menu item in each of the screens.

The current selection is shown as a blue bar with white text.

5.4 Adjusting display

Display brightness and choosing day time/night time mode

Note!

The display is provided with a sensor which measures the light level in the cab. This is used to automatically adjust the brightness of the display background to compensate for the surrounding light level.

Adjusting the display brightness:

Press the BRIGHTNESS key (# 7 in Figure B-69 on page 182)

Adjust the display BRIGHTNESS with the softkeys "<+> or <->"

Selecting the default brightness level:

Press the softkey "Default config".

The brightness can be handled either manually or automatically. Press the softkey „Change Control Mode" to toggle between these modes.

Note!

The display returns automatically to the previously chosen menu if you press the BRIGHTNESS key again, don't press any keys for 10 seconds or press the EXIT key. The BRIGHTNESS control is available in both, day and night mode.

This key toggles between day time and night time mode of the display.

5.5 Menu layout

The top of each screen contains a title bar and the bottom of the screen contains a softkey bar. The title bar has three parts:

- The left part shows the date and time.
- The middle part shows the name of the screen.
- The right part shows the locomotive name and locomotive ID.

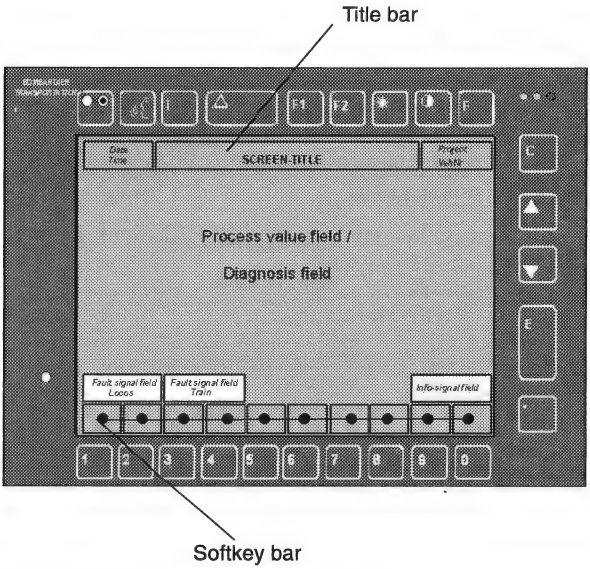


Figure B-73: General Screen Layout

The softkey bar shows the assignment of the softkeys in the current menu.

The information shown in the main part of the screen depends on the chosen menu.

Note!

Fields with a yellow background indicate faults, blue formated fields are signal fields.

5.6 Signal fields

The signal fields avoid automatic switching of screens when a particular event occurs. Two types of signal fields are defined:

Information Signal Field: This field can be in one of two states: visible or hidden. When active, the engineer sees a short text summarizing the message. The engineer presses the information key to see the full message.

The background color of an information field is bright blue.

Alarm Signal Field (one summary for the loco alarms, one summary for the train alarms): Its purpose is to inform the engineer of a fault condition on one of the vehicles. Meaning of the states of alarm signal fields:

Figure B-74: Fault Signal Field

- **Flashing yellow**: At least one fault exists on the particular vehicle type that the engineer has not yet looked at on the IDU.
- **Continuously yellow**: There is at least one fault currently active on the particular vehicle, but all faults have been looked at by the engineer.

Figure B-75: Fault Signal Field and Information Signal Field

5.6.1 Information signal fields

The information signal field consists of a short text on a bright blue background to indicate the nature of a message that has not yet been read.

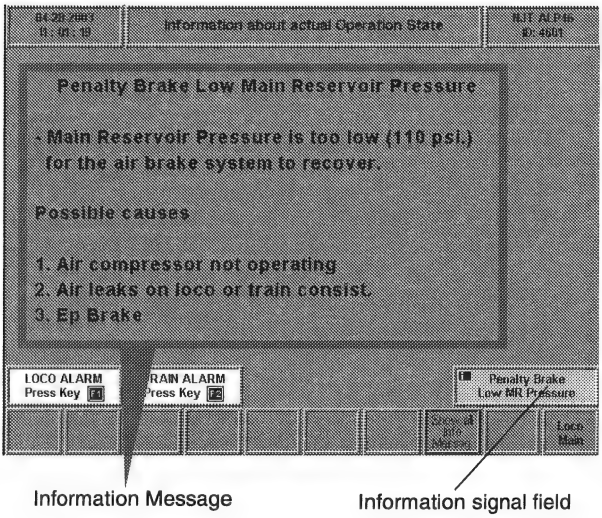


Figure B-76: Information signal field and Info Message

Press the INFO (information) key to read the full message:

INFO key

If more than one Info Message is active at the same time, the Info Message with the highest priority will be shown.
By pressing the button "Show all Messages active" in the Information Screen, all active messages are displayed one after the other for 15 seconds. If more than one Info Message is active at the same time, the Info Message with the highest priority will be shown.

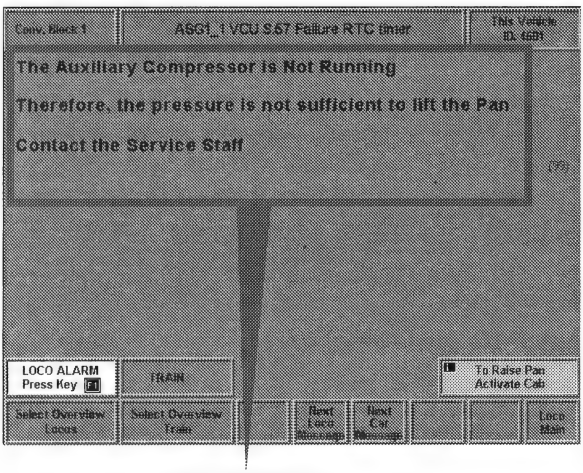
To check for faults that the workshop personnel need to be aware of, press the following key combination:

– "F" key F then "DAY / NIGHT" key

Green LED lighting means no major active fault message for workshop personnel is stored in the diagnostic computer.

Yellow LED lighting means major active fault messages for workshop personnel is stored in the diagnostic computer.

One fault signal field is provided for all the loco's in the train consist. Another field for all the cars and cabcars.



Fault signal field

Figure B-77: Fault Message Screen

The fault screen appears automatically whenever an fault occurs while the display is dark.

Pressing repeatedly the "F1" key again, or pressing the "next Loco Message" soft key shows all currently active fault messages of all loco's connected to WTB in chronological order.

The latest fault of the loco with the lowest UIC number is shown first.

If all the faults of one loco are shown, the latest fault of the loco with the next higher UIC number ist shown. This continues untill all the faults of all the loco's are shown.

5.6.2 Locomotive Alarms

Press „Select Overview Locos" to reach this screen from the Fault Message Screen.

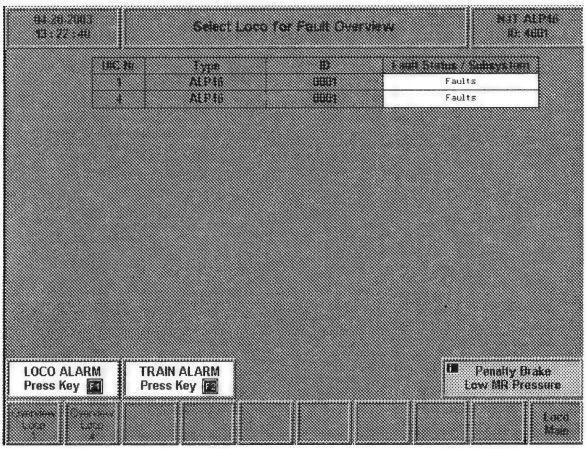


Figure B-78: Loco Alarm Overview

All Locos connected to the WTB are displayed in the selection table containing the UIC (vehicle)-number, the vehicle-type, the vehicle ID and the fault-signal field.

The appropriate fault list appears upon selecting the desired loco by pressing the corresponding softkey. The number of the soft key coressponds to the UIC-number.

5.6.3 Train Alarms

Press „Select Overview Train“ to reach this screen from the Fault Message Screen.

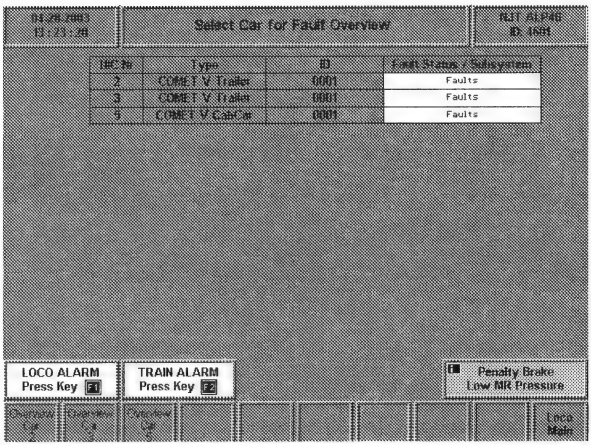


Figure B-79: Train Alarm Overview

All cars and cabcars connected to the WTB are displayed in the selection table containing the UIC(vehicle)-number, the vehicle-type, the vehicle ID and the fault-signal field.

Up to 16 vehicles connected to WTB can be selected for fault overview.

The appropriate fault list appears upon selecting the desired loco by pressing the corresponding softkey. The number of the soft key coressponds to the UIC-number.

Select the required fault message using the cursor keys.

Highlight (blue mark) and press the ENTER key to view the full fault message, or press the softkey "Show Message".

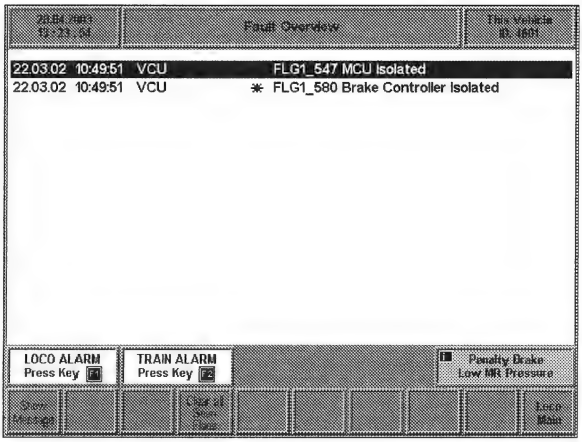


Figure B-80: Vehicle Vault Overview

Fault messages which have already been viewed are marked with an asterisk ('*').

Proceed as follows to view the full fault message:

Press the SHIFT and ENTER key combination or pressing the softkey "Clear all Seen Flags".

The tag "viewed" is deleted for all active faults and the active faults can be viewed once more by pressing the „F1" or „F2" key in the Fault Message Screen (8000).

There is no automatic refreshing of this screen, when status of faults changes.

Press the FUNCTION key to return refresh the screen

5.7 Menu structure

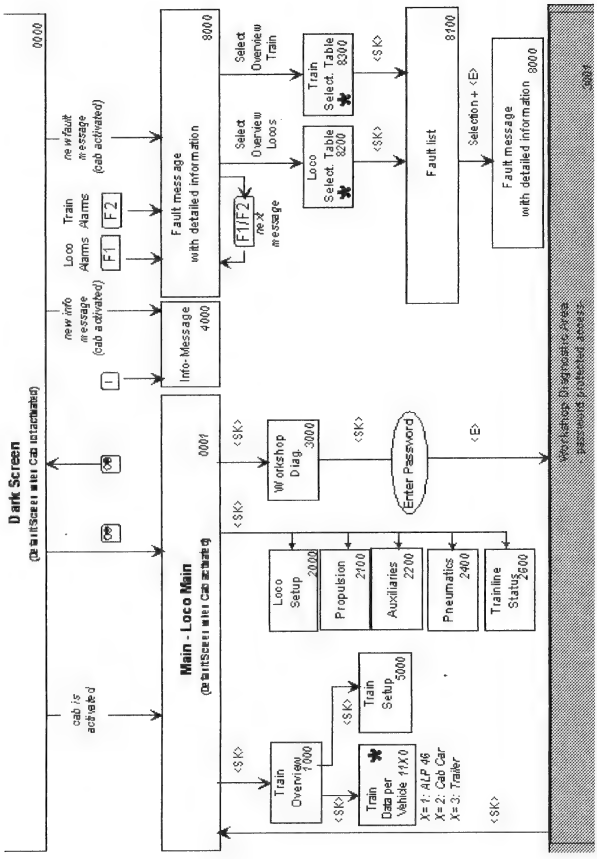


Figure B-81: Menu structure of the IDU

The screens that can be shown on the IDU are hierarchically arranged in a tree structure. Starting from the top, the user descends interactively via sub-menus (using the keyboard) until the required screen is reached.

5.8 Menus

5.8.1 General

The following process value screens may contain the following visualization elements:

- **State fields:** They contain state information texts on a specific state dependent background color. One state field may contain several different texts. The background color is:
  - *blue* for special / important operation modes (e.g. 'MCB Off') or important active states (e.g. 'Brakes Applied') which e.g. prevent the locomotive from driving or do not represent the usual operation state.
  - *white* for special / important normal operation modes (e.g. Cab active).
  - *yellow* for fault states (e.g. 'Fault'; 'Isolated'). In case of unreliable values, state fields will show '???' on yellow background.
  - *grey* for 'normal' states (ready to drive).

- **Numeric fields:** Usually they contain numerical process values. Their background is always grey. In case of unreliable values numeric fields will show '???'.
- **Bar graphs:** They are used to a better visualization of dynamically process values. The color of the bar is blue or in some cases white e.g. braking effort
- **Graphic symbols:** They are primary used in screen "Train Overview". Their possible background colors are blue, yellow, white or grey as described for state fields above.

Thus no blue or yellow color is visible in the trouble free and ready to drive state.

EDITION C: 2003. SEP. 15

5.8.2 Main menu

The main menu is shown automatically after pressing the "ON/OFF" key.

Note!

Operating parameters and process data shown in the following are examples only and do not correspond to real operating values.

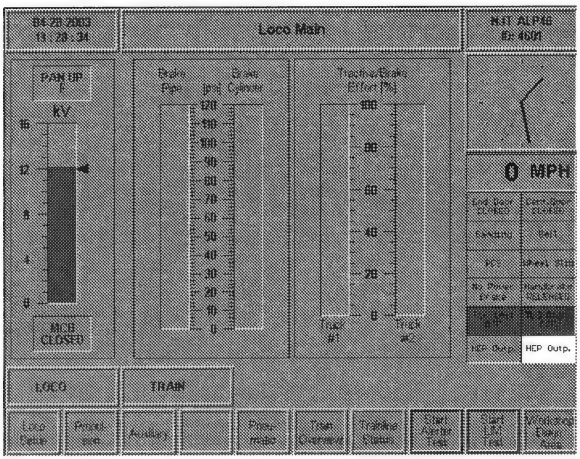


Figure B-82: Example of Main menu (ID 0001)

There are Pop-up fields for certain actions / commands.

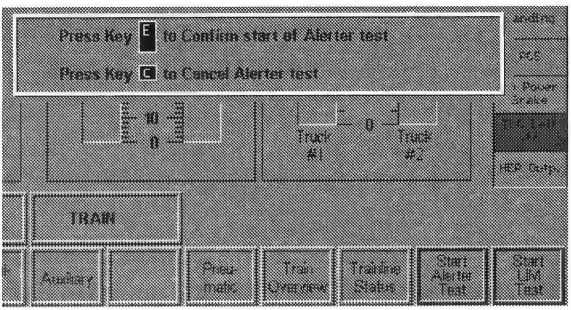


Figure B-83: Pop-up field „Start Alerter Test"

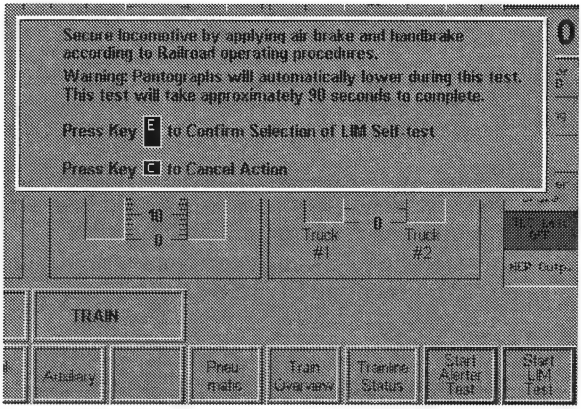


Figure B-84: Pop-up field „Start LIM Test“

Information	Unit	Background color	Comments
Line Voltage	kV	(blue)	3 Systems
Actual T/B effort bogie 1	%	(blue)	Tractive Effort bogie 1
			Braking Effort bogie 1
Actual T/B effort bogie 2	%	(blue)	Tractive Effort bogie 2
			Braking Effort bogie 2
Brake Pipe Pressure	psi	(blue)	Brake Pipe Pressure Loco
Brake Cylinder Pressure	psi	(blue)	Brake Cylinder Pressure Loco
Actual Speed	mph	(gray)	Value hidden,
when ATP is active and not simulation mode			
State MCB		MCB OPEN (blue)	
		MCB CLOSED (gray)	
State Pantograph		PAN DOWN (blue)	
		PAN UP F (gray)	
		PAN UP F & B (gray)	
		PAN UP B (gray)	
State End Doors		End Door OPEN (blue)	Trainline information
		End Door CLOSED (gray)	

Information	Unit	Background color	Comments
State Center Doors		Center Door OPEN (blue)	Trainline information
		Center Door	
CLOSED (gray)			
Sanding		Sanding (gray)	
		Sanding ON (blue)	
Bell		Bell (gray)	
		Bell ON	
PCS		PCS (gray)	
		PCS ON	
Wheel Slip		Wheel Slip (gray)	
		Wheel Slip ON	
No Power Brake		No Power Brake (gray)	
		No Power Brake	
Handbrake		Hanbrake	
RELEASED (gray)			
		Handbrake	
APPLIED (blue)			
TLC Left		TLC Left OFF (blue)	
		TLC Left ON (gray)	
TLC Right		TLC Right OFF (blue)	
		TLC Right ON (gray)	
HEP Output ON		HEP Output (gray)	
		HEP Output ON	
HEP Output OFF		HEP Output (gray)	
		HEP Output OFF	
State of Alerter Test		Start Alerter Test (gray)	<SK> Label feedback of the Alerter Test
		Alerter Test Active	
State of LIM Test		Start LIM Test (gray)	<SK> Label feedback of the LIM Test
		LIM Test active	

5.8.3 Local Process Values

Within the following screens are displayed local process values of the subsystems.

5.8.4 Loco Setup

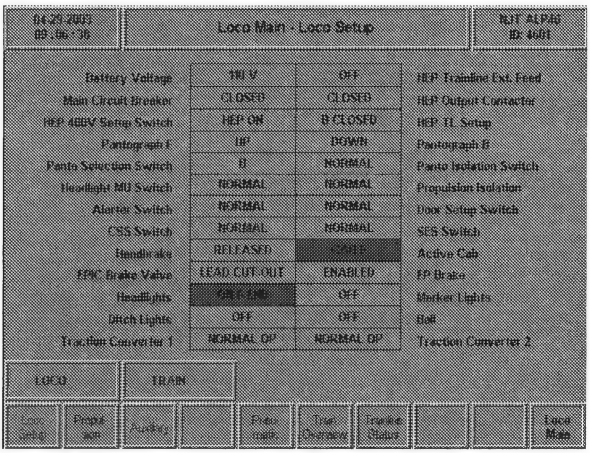


Figure B-85: Loco Setup menu (ID 2000)

Information	Unit	Background color
Battery Voltage	V	
HEP Trainline Ext. Feed		OFF
		ON
Main Circuit Breaker		OPEN
		CLOSED
HEP Output Contactor		OPEN
		CLOSED
		ISOLATED
HEP 480V Setup Switch		OFF/WAYSIDE
		HEP ON
		DEAD
		OFF/THRU
HEP TL Setup		F CLOSED
		B CLOSED

Information	Unit	Background color
		F+B CLOSED
		F+B OPEN
Pantograph F		DOWN
		UP
		UP (ISOL)
		ISOLATED
Pantograph B		DOWN
		UP
		UP (ISOL)
		ISOLATED
EPIC Brake Valve		LEAD CUT-IN
		LEAD
		TRAIL
Headlights		
		ON F-END
		ON B-END
		ON F+B END
		OFF
Panto Selection Switch		
		F
		B
		BOTH
		LOC DOWN
Panto Isolation Switch		F
		B
		NORMAL
Headlight MU Switch		F
		B
		NORMAL
Propulsion Isolation		NORMAL
		ISOLATED
Alerter Switch		NORMAL
Door Setup Switch		NORMAL
		END DOOR
CSS Switch		NORMAL
SES Switch		NORMAL

Information	Unit	Background color
Handbrake		RELEASED
		APPLIED
Marker Lights		ON F-END
		ON B-END
		ON F+B END
		OFF
Active Cab		CAB F
		CAB B
		NONE
State EP Brake		
		CUT OUT
		ENABLED
		CUT OUT
Traction Converter 1		OFF
		NORMAL OP.
		ISOLATED
		FAULT
Traction Converter 2		OFF
		NORMAL OP.
		ISOLATED
		FAULT
HEP 480V SetUp Switch		
		OFF/Wayside
		HEP ON.
		Dead
		Off/Thru
Ditchlights		OFF / ON
Bell		OFF / ON

5.8.5 Propulsion

Note!

This overview provide propulsion-specific process data

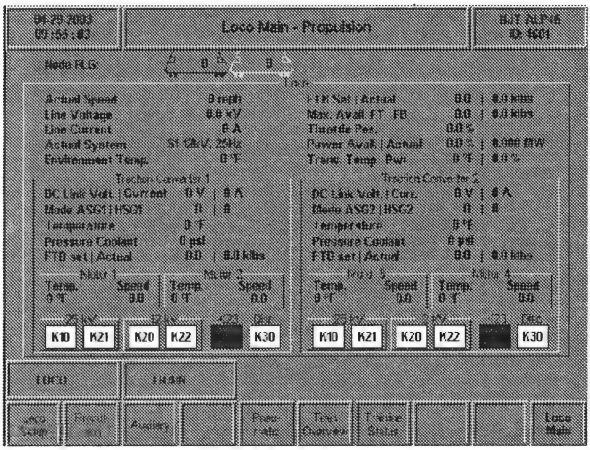


Figure B-86: Propulsion menu (ID 2100)

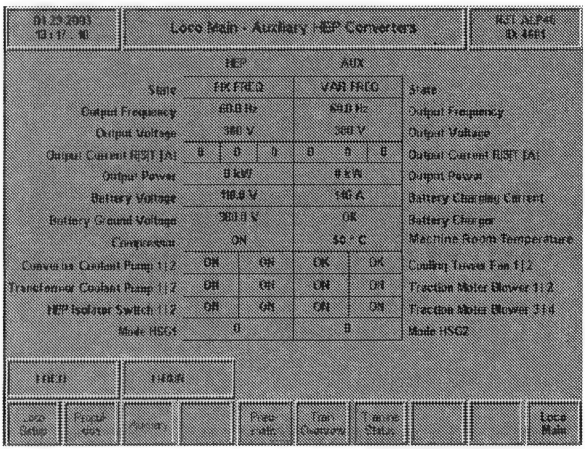


Figure B-87: Auxiliary HEP Converters (ID 2200)

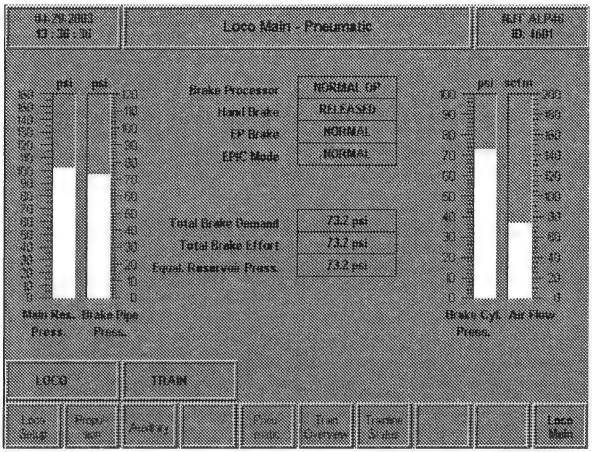


Figure B-88: Pneumatic menu (ID 2400)

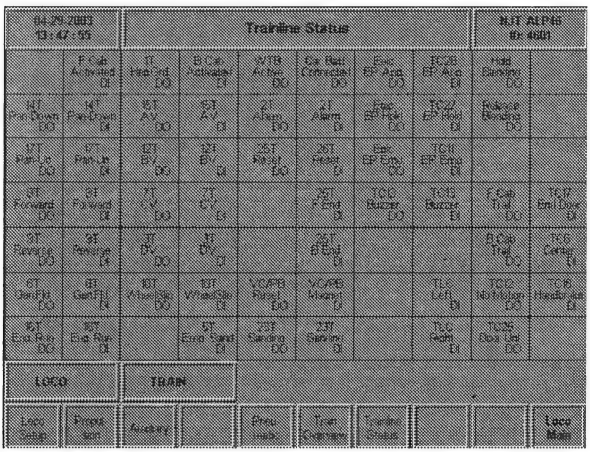


Figure B-89: Trainline Status menu (ID 2600)

NOT AVAILABLE 203 to 217

5.8.6 Train overview menu

The train overview menu shows information on all Locos ALP-46 in the entire train consist.

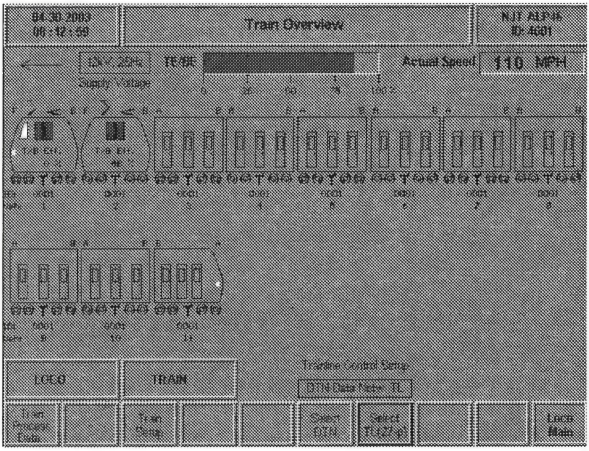


Figure B-90: Train overview menu (ID 1000)

Note!

The driving engineer must use the softkeys to choose one of the following control modes:

- Process Data of DTN - one screen per vehicle
- Trainline mode
- Loco main screen

The train overview shows a maximum of 16 vehicles (2 rows of 8 vehicles), including the following vehicle types:

- Locomotive ALP-46 (max. 4)
- Comet V Trailer
- Comet V Cab Car

Note!

If WTB (DTN) Network is not available, the local information of the own vehicle is displayed only.

Train Configuration and Selection of Remote Control Mode

Whenever the the train configuration changes, the screen Figure B-90 on page 203 is refreshed automatically.

The engineer can check the train configuration within this screen and compare it to the physical train configuration. If they are identical, he can select DTN-Mode. Otherwise he has to select trainline mode TL. For assistance an info message of recommended mode will be provided to the engineer. Default mode is trainline mode.

Information Items in Train Overview

When entering this screen manually, the below information items are displayed, if the communication on DTN to the vehicle is ok. If there is no valid process data achieved from a vehicle, the corresponding box in the graphical train overview will be marked.

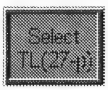
Information	Unit	Text	Comment
General Information:			
Actual Mode of Remote Control		Trainlines	
		DTN	
Command for DTN Mode			<SK> Input for Selecting DTN (WTB) Mode
Command for Trainline Mode			<SK> Input for Selecting Trainlines Mode

Table B-3: Command Items of „Train Overview" screen

EDITION C: 2003. SEP. 15

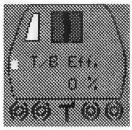
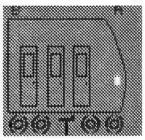
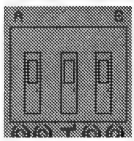
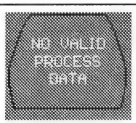
Supply Voltage		12kV, 25Hz	System 1
		12.5kV, 60Hz	System 2
		25kV, 60Hz	System 3
		Kassel, 50Hz	System 4
TE/BE train	%		tractive effort train
Actual Speed		mph	Value hidden, when ATP is active and not simulation mode
Vehicle Type		 ALP46	Graphical Symbol
		 COMET V Cab Car	Graphical Symbol
		 COMET V Trailer	Graphical Symbol
Data are invalid			Graphical Symbol not visible
			Graphical Symbol

Table B-3: Command Items of „Train Overview“ screen

Information	Unit	Text	Comment
State Pantograph B		 DOWN	Graphical Symbol
		 UP	Graphical Symbol
		 UP (Isol.)	Graphical Symbol
		 ISOLATED	Graphical Symbol
State Pantograph B		 DOWN	Graphical Symbol
		 UP	Graphical Symbol
		 UP (Isol.)	Graphical Symbol
		 ISOLATED	Graphical Symbol
State MCB		 OPEN	Graphical Symbol
		 CLOSED	Graphical Symbol
		 ISOLATED	Graphical Symbol
State Cab F			Graphical Symbol not visible
		 ACTIVATED	Graphical Symbol
State Cab B			Graphical Symbol not visible
		 ACTIVATED	Graphical Symbol
Actual T/B effort	%		

Table B-4: Information Items concerning ALP-46

State Handbrake State Brake		 RELEASED	Graphical Symbol
		 APPLIED	Graphical Symbol
		 RELEASED	Graphical Symbol
		 APPLIED	Graphical Symbol
		 SWITCHED OFF	Graphical Symbol
		 FAULT	Graphical Symbol
End marker light END F			Graphical Symbol not visible
		 ON	Graphical Symbol
End marker light END B		OFF	Graphical Symbol not visible
		 ON	Graphical Symbol
Vehicle ID number			Maximum 8 Digits
Vehicle Number = UIC Node Number			Dynamically due to WTB Inauguration
Status of Fault Indicator			No Faults
		Faults	Acknowledged Active
		Faults (flashing)	Unacknowledged Active

Table B-4: Information Items concerning ALP-46

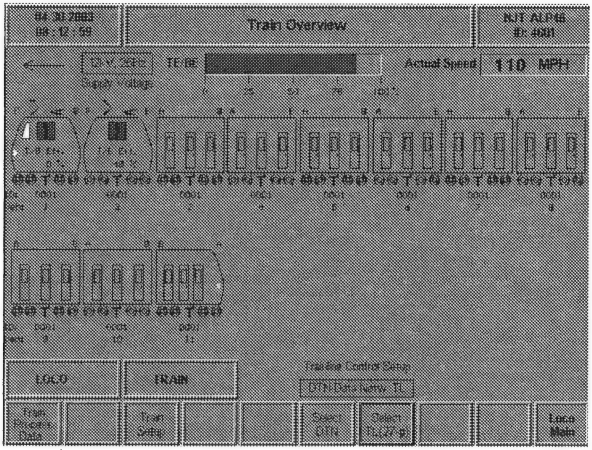


Figure B-91: Train overview menu (ID 1000)

Information	Unit	Text	Comment
State Cab			Graphical Symbol not visible
		ACTIVATED	Graphical Symbol
Door END A (state of door 2)		LOCKED	Graphical Symbol
			Graphical Symbol
		CLOSED	Graphical Symbol
		OPEN	Graphical Symbol
		EMERGENCY	Graphical Symbol

Doors MIDDLE (Summary state of doors 5 to 8)		 LOCKED	Graphical Symbol *All doors in this group are locked (and closed).*
			Graphical Symbol *At least one door of this group is Cut Out. None of the other doors of this group are in closed state, emergency state or open state.*
		 CLOSED	Graphical Symbol *At least one door of this group is closed (but not locked). None of the other doors of this group are in emergency state or open state.*
		 OPEN	Graphical Symbol *At least one door of this group is open. None of the other doors of this group are in emergency state*
		 EMER-GENCY	Graphical Symbol *At least one door of this group is in emergency state. The states of the other doors are not relevant.*
Doors END B (Summary state of doors 3 and		 LOCKED	Graphical Symbol *same as Doors Middle*
			Graphical Symbol *same as Doors Middle*
		 CLOSED	Graphical Symbol *same as Doors Middle*
		 OPEN	Graphical Symbol *same as Doors Middle*
		 EMER-GENCY	Graphical Symbol *same as Doors Middle*

State Hand-brake		 RELEASED	Graphical Symbol
		 APPLIED	Graphical Symbol
State Brake		 RELEASED	Graphical Symbol
		 APPLIED	Graphical Symbol
		 SWITCHED OFF	Graphical Symbol
		 FAULT	Graphical Symbol
End Marker Light END A		OFF	Graphical Symbol not visible
		 ON	Graphical Symbol
End Marker Light END B		OFF	Graphical Symbol not visible
		 ON	Graphical Symbol
Vehicle ID Number			Maximum 8 Digits
Vehicle Number = UIC Node Number			Dynamically due to WTB Inauguration
Status of Fault Indicator			No Faults
		Faults	Acknowledged Active
		Faults (flashing)	Unacknowledged Active

Table B-5: Information items concerning Comet V Cab Car

Information	Unit	Text	Comment
Doors END A (Summary state of doors 1 and 2)		 LOCKED	Graphical Symbol *All doors in this group are locked (and closed).*
			Graphical Symbol *At least one door of this group is Cut Out. None of the other doors of this group are in closed state, emergency state or open state.*
		 CLOSED	Graphical Symbol *At least one door of this group is closed (but not locked). None of the other doors of this group are in emergency state or open state.*
		 OPEN	Graphical Symbol *At least one door of this group is open. None of the other doors of this group are in emergency state*
		 EMER-GENCY	Graphical Symbol *At least one door of this group is in emergency state. The states of the other doors are not relevant.*

Table B-6: Information items concerning Comet V Trailer Car

Information	Unit	Text	Comment
Doors MIDDLE (Summary state of doors 5 to 8)		 LOCKED	Graphical Symbol *same as Doors End A*
			Graphical Symbol *same as Doors End A*
		 CLOSED	Graphical Symbol *same as Doors End A*
		 OPEN	Graphical Symbol *same as Doors End A*
		 EMER-GENCY	Graphical Symbol *same as Doors End A*
Doors END B (Summary state of doors 3 and 4)		 LOCKED	Graphical Symbol *same as Doors End A*
			Graphical Symbol *same as Doors End A*
		 CLOSED	Graphical Symbol *same as Doors End A*
		 OPEN	Graphical Symbol *same as Doors End A*
		 EMER-GENCY	Graphical Symbol *same as Doors End A*

Table B-6: Information items concerning Comet V Trailer Car

Information	Unit	Text	Comment
State Hand-brake		 RELEASED	Graphical Symbol
		 APPLIED	Graphical Symbol
State Brake		 RELEASED	Graphical Symbol
		 APPLIED	Graphical Symbol
		 SWITCHED OFF	Graphical Symbol
		 FAULT	Graphical Symbol
End Marker Light END A			Graphical Symbol not visible
		 ON	Graphical Symbol
End Marker Light END B			Graphical Symbol not visible
		 ON	Graphical Symbol
Vehicle ID Number			Maximum 8 Digits
Vehicle Number = UIC Node Number			Dynamically due to WTB Inauguration
Status of Fault Indicator			No Faults
		Faults	Acknowledged Active
		Faults (flashing)	Unacknowledged Active

Table B-6: Information items concerning Comet V Trailer Car

5.8.7 Vehicle Specific Process Data via DTN

Within the **Train Overview** menu (ID 1000) one addional screen per vehicle is available by pressing the softkey "Train Process Data", containing key process data from the corresponding vehicle type, which is:

- Locomotive ALP 46 (screen ID 1110)
- Comet V Trailer (screen ID 1120)
- Comet V Cab Car (screen ID 1130)

The relevant screen of one vehicle can be selected by the <SK> "Process Data Veh. x", if the communication on DTN to this vehicle is ok

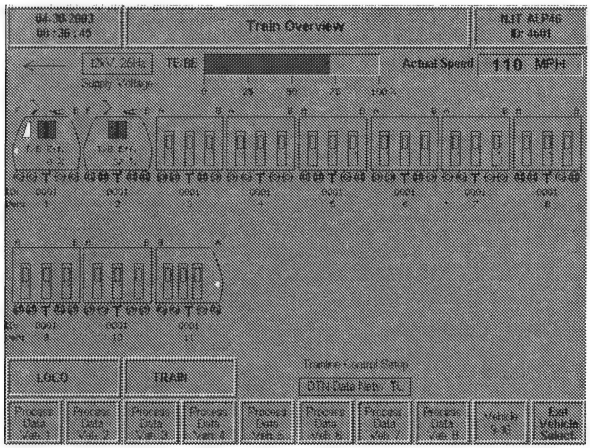


Figure B-92: Specific process data within Train Overview menu

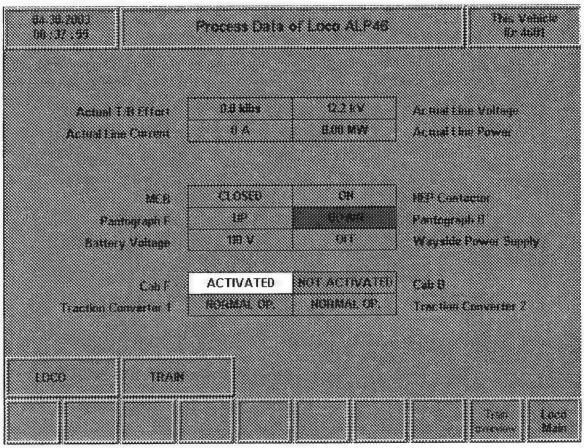


Figure B-93: Process data of ALP-46

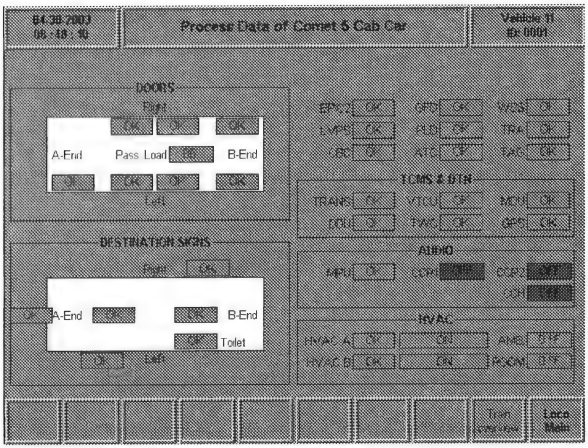


Figure B-94: Process data of Comet V Cab Car

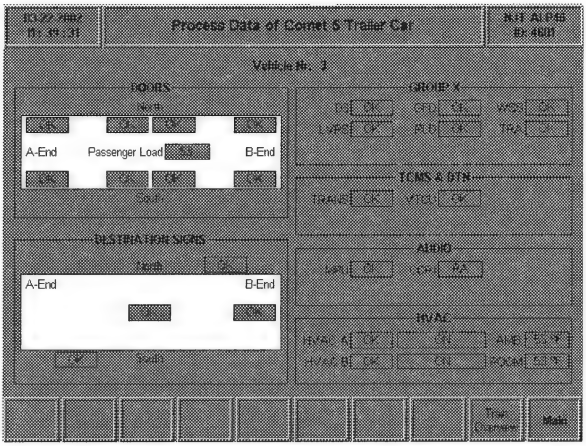


Figure B-95: Process data of Comet V Trailer Car

5.8.8 Train Setup Screen

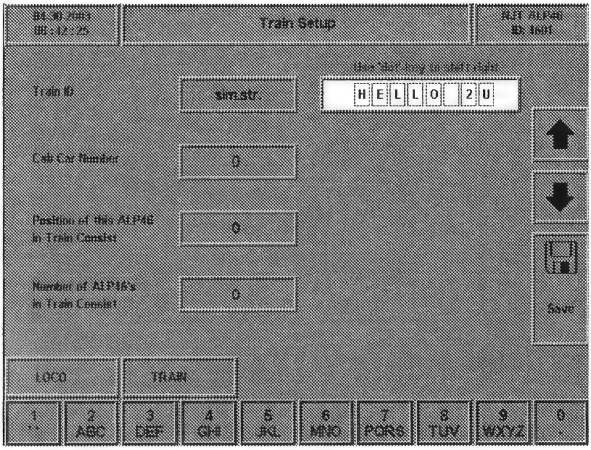


Figure B-96: Train Setup menu (ID 5000)

The engineer enters values concerning the actual train configuration via this screen.

Information / Command	Unit	Comment
Set Train ID	8 characters	<SK> Input
Actual Train ID	8 characters	
Set Cab Car Number	4 digits	<SK> Input
Actual Cab Car Number	4 digits	
Set Position of this ALP46 in Train Consist	4 digits	<SK> Input for shifted firing (ignored when DTN is active)
Actual Position of this ALP46 in Train Consis	4 digits	
Set Number of ALP46's in Train Consist	4 digits	<SK> Input for shifted firing (ignored when DTN is active)
Actual Number of ALP46's in Train Consist	4 digits	

5.8.9 Enter Password menu:

This menu and its sub-menus are only intended for maintenance personnel.

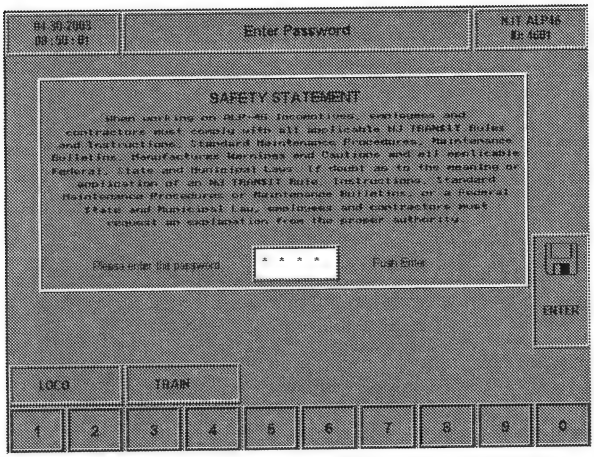


Figure B-97: Workshop diagnosis - Enter password menu (ID 3000)

It is necessary to enter a password to access the sub-menus.

C Press the CLEAR key to return to the previous menu.

5.9 IDU faults

5.9.1 IDU temperature too high

Note!

The IDU display background illumination is reduced by 50% above an IDU temperature of 140°F.

The red LED flashes slowly in this case.

Note!

The power feed to the IDU display is switched off above an IDU temperature of 160°F.

The red LED flashes quickly in this case.

Note!

The IDU is switched off completely after a time delay above an IDU temperature of 185°F.

5.9.2 IDU temperature too low

Note!

The IDU is heated automatically if the IDU temperature drops below 32°F.

The red LED flashes slowly in this case.

C Operation

6 Preparing the Locomotive

6.1 Preparing the locomotive for use

Work outside of the locomotive

- Check that no-one is working on the locomotive (check for warning flags or signs).

High Voltage! Mortal Danger!

When unit is under a catenary, make roof inspections only from the ground.

- Check that the pantographs are lowered.
- Check that the wayside power cables have been removed.
- Check the applied brake indicators to make sure that the locomotive cannot roll away.
- Make a visual inspection for:
  - Air and oil leaks
  - Dragging, defective or loose equipment under locomotive
  - Proper condition of all tread brake shoes and brake disc pads

Mortal Danger!

Report heavy wear and damage to the service department before moving the locomotive. The service department can then decide whether the locomotive can be used or not.

- Only in case of a dead locomotive install two short HEP Loop Jumper Cables {35.2} to interconnect the two pairs of HEP TL receptacles {35.11} to {35.14} at the not coupled end of the dead locomotive when it is to be trailed.
- Apply the hand or air brakes, make sure

that the brakes are applied.

- and then remove the chocks or chains.
- Check that the cock for the air drying equipment is not set to "bypass".
- Unlock the door to Cab F.

Work in Cab F- Part I

- Check that the Battery Disconnecting Switch {113} is set to ON (i.e. normal operation). The switch is inside the LVC.
- Switch on the cab lights if necessary.
- Check that all circuit breakers in the consoles and the rear wall of the cab are switched on.
- Check that all cut out switches are in the correct position for normal operation of the locomotive.
- Switch on the vehicle control electronics by switching the Battery Contactor Switch {125} to ON. The vehicle control electronics will then start up automatically after carrying out a self test.
- insert the reverser handle in the controller.
- Put the indication lamp switch on panel CSP2 to ON to carry out the indicator lamp and buzzer test when the cab is activated. During the test, all lamps are switched on for 5 s for testing except for the CCU (brake handles) on the engineer's desk.
- Check the temperature of the transformer and the two traction converters on the IDU and make sure that the temperatures are in range.
- Switch on the machine room lights.

Work in Cab B

- Switch on the cab lights if necessary.
- Move the independent brake handle to the RELEASE position.
- Move the automatic brake handle to the HO position.

- Check the horn.
- Put the indication lamp switch on panel CSP2 to ON to carry out the indicator lamp and buzzer test when the cab is activated. During the test, all lamps are switched on for 5 s for testing except for the CCU (brake handles) on the engineer's desk.
- Switch on headlights and/or marker lights if necessary.
- Check that all circuit breakers in the consoles and the rear wall of the cab are switched on.
- Switch off the cab lights.
- Close all windows and doors.
- Go to cab F and insert the reverser handle in the controller. Move the reverser to Neutral (N). Most of the operating elements should now be active in this cab.

Work in the machine room

- Check that all cut out switches are in the correct position for normal operation of the locomotive.
- Check that all circuit breakers in the LVC and ASD are switched on.
- Check the oil level in the compressor.
- Check the coolant level in traction converters 1 and 2.
- Check the coolant level in the transformer.
- Check that key multipliers 1 and 2 are set for normal operation and are not set to ground the HVC.
- Check that all air compressed cocks are open.
- If necessary, open the cut out cock [29/2] of the 25 l auxiliary reservoir on the auxiliary panel of the CMP.

Work in Cab F - Part II

- Make sure that the brakes are applied.
- Put the Pantograph Selection switch to

the required position.

- Put the Pantograph Isolation switch to the "NORMAL" position.
- View the duplex air gauges in the cab to make sure that the main reservoir air pressure is in range.
- Close the cut out cock [29/2] of the 25 l auxiliary reservoir on the auxiliary panel of the CMP.
- Move the reverser to Neutral (N). Most of the operating elements should now be active in this cab.
- Switch the Toggle Switch Pantograph {129} (on the Desk Center Switch Panel CDPM) to PAN UP. This raises the previously selected pantograph and closes the MCB as soon as the catenary voltage is detected.
  If the air pressure is too low, the auxiliary compressor (battery powered) starts operating automatically to provide sufficient compressed air for pantograph and MCB operation.
- Check for the presence of catenary voltage on the IDU.
- Switch on headlights and/or marker lights if necessary.
- Adjust the air conditioning equipment as required.
- Switch on the train radio equipment.
- Apply the independent and automatic brakes.
- Release the hand brake in the machine room.
- Close all windows and doors.

6.2 Raising the pantographs

- Check for released pantograph lock down and grounding claws.
- Check that all cut out switches in the cab and in the machine room are in the correct position for normal operation of the locomotive (HEP TL is ON).
- Make sure that the Battery Disconnecting Switch {113} (inside the LVC) is ON.
- Switch on the vehicle control electronics by switching the Battery Contactor Switch {125} to ON (cab F only). The start up procedure of the electronics is initiated automatically (check battery fuses if not successful!).
- Put the Pantograph Selection Switch {129.2} (cab F only) in the required position to prepare to raise the corresponding pantograph.
- Put the isolation switch (cab F only) to the NORMAL position (the pantograph disconnection switches are normally closed).
- View the duplex air gauges in the cab to make sure that the main reservoir air pressure is in range.
- If necessary, open the cut out cock [29/2] of the auxiliary reservoir on the auxiliary panel of the CMP.

6.3 Additional preparation

- Check that the brakes are applied by inspecting the brake applied indicators on the outside of the locomotive.
  Close the cut out cock [29/2].
  Since no cab is active yet, the OUT button should be lit in cab F and the TRAIL button should be lit in cab B (press the OUT button if you intend to occupy cab B).
- Move the reverser to Neutral (N). Most of the operating elements should now be

active in this cab

- At temperatures below 14°F, the control electronics checks the temperature of the cooling fluid for the traction converters. If the cooling fluid is between -4°F and 14°F, the start up will be delayed until the system has warmed up the cooling fluid to above 14°F. If the cooling fluid is below -4°F, an external 480V supply is needed. Please note too the corresponding messages on the IDU.
- Put the Toggle Switch Pantograph {129} (on the Desk Center Switch Panel CDPM) to PAN UP. This raises the previously selected pantograph and closes the MCB as soon as the catenary voltage is detected.
  If the air pressure is too low even if the auxiliary cut out cock [29/2] is open, the auxiliary compressor (battery powered) starts operating automatically to provide sufficient compressed air for pantograph and MCB operation.
- Move the reverser to Forward (F) or Backward (B). The automatic brake will now go to the IN position (to cut-in the brake) and the other cab will go to TRAIL (i.e. the automatic brake is cut out).
- Conduct a brake test as per standard NJTransit operating rules.

6.4 Setting up the non-operated cab

A non-operated cab must have the controls set in the following way:

- Move the Automatic brake handle to the HANDLE OFF position.
- Move the Independent brake handle to the RELEASE position.
- Check that the ER gauge decreases to 0 psi.
- Check that the BP gauge decreases to 0 psi.
- Check the BC gauge.
- Move the throttle to 0 (detent).
- Move the reverser to Isolated (I) when the ER and BP pressure has decreased to 0 psi.
- Check that the OUT indicator is lit.
- Press the TRAIL button and check that the TRAIL indicator is lit.
- Set light and heater switches as required.

6.5 Setting up the operated cab

Initial conditions (cab has been correctly de-activated before):

- Move the automatic brake handle to the HANDLE OFF position.
- Move the independent brake handle to the RELEASE position.
- Check that the ER gauge indicates 0 psi.
- Check that the BP gauge indicates 0 psi.
- Check the BC gauge.
- Check the MR gauge.
- Move throttle to 0 (detent).
- Move the reverser to Isolated (I).

An operated cab must have the controls set in the following way:

- Move the reverser out of Isolate.

- Check that the IN indication is lit.
- Move the Independent brake handle to the FULL APPLICATION position.
- Check the BC gauge.
- Move the Automatic brake handle to the RELEASE position when appropriate.
- Check the ER gauge.
- Check the BP gauge.
- Allow three (3) minutes for the equipment to charge.
- To check for the correct ATC operating setup on the ADU, move the reverser to F, N or R.
- When in a train consist, enter the cab car number on the IDU.
- Put the light and heater switches in the desired positions.
- Put the Headlights MU switch on the CRWPF to NORMAL (if the locomotive is in single operation) or to the position corresponding to the end where the second locomotive is coupled (if the locomotive is in MU operation).
- Put the EP Brake switch on CSP1 to ON.

6.6 Preparing a cab for push operation

Preparing the locomotive for push operation is similar to a non-activated cab (refer also to chapter 6.3):

- Cab is not active
- Move the Automatic brake handle to the HANDLE OFF position.
- Move the Independent brake handle to the RELEASE position.
- Move the reverser to Isolated (I) when the ER and BP pressure has decreased to 0 psi.
- Check that the OUT indication is lit.
- Put the Marker Light Switch on CDPL to ON.
- Put the EP Brake Switch on CSP1 to CUT-OUT.

Note!

These steps provide 74 VDC battery voltage to the cab for control power. If not, move reverser to position "I".

- Remove the reverser handle(s) from the controller and store in the proper location.

Note!

To configure the pantographs for Push Operation, follow the NJTransit operating rules and heed all warnings regarding the raising and lowering of pantographs and the setting of related switches.

Some controls are also available in the de-activated cab, e.g. radio, but only those controls which do not interfere with safe operation of the locomotive.

7 Operating the Locomotive

7.1 Activating the engineer's desk

- Insert the reverser handle after the locomotive is correctly switched on (refer to section 6).
- Move the reverser handle to R, N or F
  - The corresponding cab gets activated and all controls are now available.

Some controls are also available in the deactivated cab, e.g. radio, but only those controls which do not interfere with safe operation of the locomotive.

EDITION C: 2003. SEP. 15

7.2 Testing the brakes

Pantograph is raised and the cab is activated.

Warning!

Secure the locomotive with stop blocks to prevent it from rolling

7.2.1 Activating the automatic brake valve

Start the test with Cab F

- Move the independent brake handle to the "Release" position
- Move the automatic brake handle to the "HO" position
- Insert the Reverser Handle of the Controllers in the "I" position
  - The "TRAIL" indicator of the automatic brake valve goes on
- Move the Reverser Handle to the "N" position
  - The "TRAIL" indicator goes off
  - The "OUT" indicator goes on
- Move the automatic brake handle from "HO" to "LAP"
  - The "OUT" indicator goes off
  - The "IN" indicator goes on

7.2.2 Brake pipe leakage test

- Move the automatic brake handle to the "HO" position and allow the ER and BP gauge indications to decrease to 100 psi, then push the "OUT" button
  - Check that the "OUT" button is lit.
- Wait 1 minute for the BP pressure to stabilize.
- Wait 5 minutes for the leakage test.
  - Check that BP psi decreased by less than 1.5 psi.
- Move the automatic brake handle to the "LAP" position.
- Push the "IN" Button
  - Check that the "IN" button is lit
- Move the automatic brake handle to the "REL" position.

7.2.3 Independent brake test

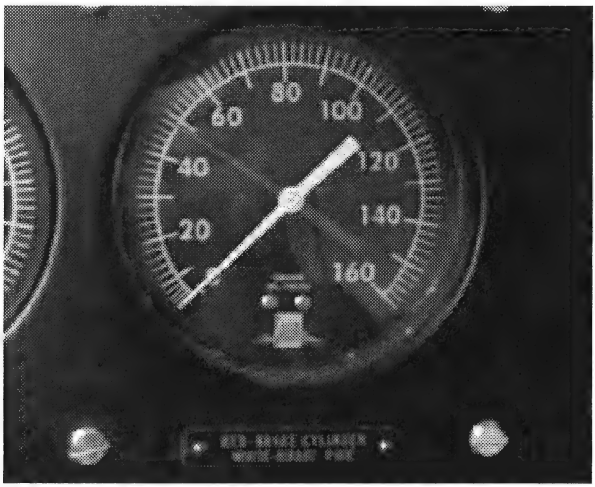


Figure C-1: BC Gauge (brake cylinder pressure)

- Move the automatic brake handle to the "REL" position.
- Move the independent brake handle to the "REL" position.

- Check that the BC gauge indicates 0 psi.

– Check that the brake applied indicators on the outside of the locomotive show green.

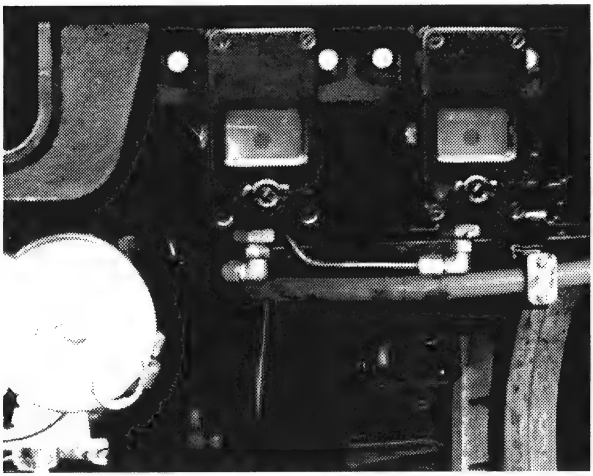


Figure C-2: Brake applied indicators

– Check that the brake pads are released.

– Apply the independent brake step by step until the max. position APL is reached.

– Check that the brake cylinder pressure increases step by step until the max. pressure is reached.

  - Max. brake cylinder pressure (BC gauge) should be 72 psi.

– Check that the brake applied indicators on the outside of the locomotive show red.

– Release the automatic brake.

  - Check that the BC gauge indicates 0 psi.

7.2.4 Automatic brake test

- Check that the BP and ER gauges indicate 110 psi.
- Check that the BC gauge indicates ZERO (0) psi.
- Move the automatic brake handle to the "SERVICE" position.
- When the ER gauge indication has decreased to 80-85 psi, move the automatic brake handle to the "LAP" position.
  - Check that the BC gauge indicates 61 to 64 psi.
- Move the automatic brake handle to the "HO" position.
  - Check that the BP and ER gauge indications continue to decrease to 0 psi.
  - Check that the BC gauge remains at 61 to 64 psi.
- Move the automatic brake handle to the "REL" position.
  - Check that the BP and ER gauge indicates 110 psi.
  - Check that the BC gauge indicates ZERO (0) psi.

7.2.5 Checking the function of the brake

The separate function of the independent and automatic brake.

- Apply the independent brake until the BC gauge indicates 30 psi.
- Apply the automatic brake until the BC gauge indicates 60 psi.
- Fully release the automatic brake
  - Check that the BC gauge indication decreases to 30 psi.

EDITION C: 2003. SEP. 15

7.2.6 Emergency brake valve

– Operate the lever for the emergency brake valve

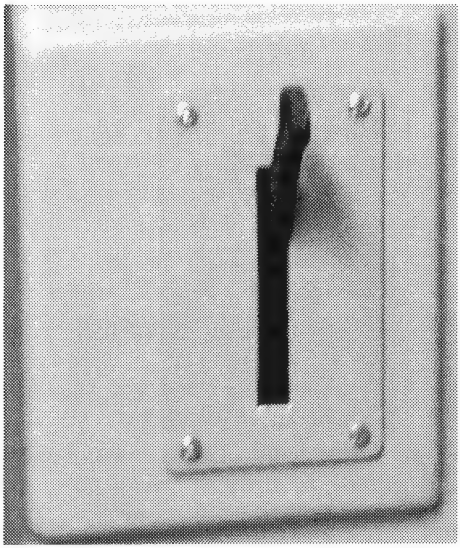


Figure C-3: Emergency brake valve

– The brake pipe is vented outside of the locomotive until the BP gauge indicates 0 psi.
  - Check that the BC gauge indication increases to 72 psi.

7.2.7 Quick release

- Move the automatic brake handle to the "SERVICE" position. When the ER and BP gauges indicate 80-85 psi, move the automatic brake handle to the "LAP" position and note down the BP pressure value.
  - Check that the BC gauge indicates 61 to 64 psi.
- Move/deflect the independent brake handle to the right to the "QUICK RELEASE" position and hold for at least 4 seconds before releasing the handle.
  - Check that the BC gauge indication decreases to 5 psi in 3 to 5 seconds and continues to decrease to ZERO (0) psi.
  - Check that the BC gauge indication remains at ZERO (0) psi.
- Move the automatic brake handle to the "SERVICE" position, reduce the ER gauge indication 5-7 psi below the previous noted reduction and then move the automatic brake handle to the "LAP" position.
  - Check that the BC gauge indicates 12 to 17 psi.
- Move the automatic brake handle to the "RELEASE" position.
  - Check that the BP gauge indicates 110 psi.
  - Check that the BC gauge indicates ZERO (0) psi.

EDITION C: 2003. SEP. 15

7.2.8 Penalty brake

Penalty braking can be applied automatically by the following systems:

- Alerter Input
- Train Control (ATC) Input
  - Check that the BC gauge indication increases to 61 - 64 psi
  - Check that the BP gauge indication decreases to 64 - 68 psi

7.2.9 Electro-pneumatic apply function

- Move the automatic brake handle to the "SERVICE" position
  - Check that the ER and BP gauge indications decrease to 0 psi.
  - Check that the BC gauge indication remains at 61 to 64 psi
- Move the automatic brake handle to the "RELEASE" position.

7.2.10 Electro-pneumatic emergency function

- Move the automatic brake handle to the "EMERGENCY" position.
  - Check that the BC gauge indication increases to 71 - 73 psi.
  - Check that the power knockout occurs immediately (PCS lamp is lit).
- Move the automatic brake handle to the "RELEASE" position.
  - Check that the power knockout is reset (the PCS lamp goes out)

7.2.11 Hand brake

– Apply hand brake by pushing the button SET on the electrical Locomotive Parking Brake drive unit LPB.
  - Check indicator LED
  - The blue LED light stays lit for 5 seconds once the brake is set

In case the battery voltage is not sufficient to enable motor driven application of the hand brake the personnel has to stroke the manual set lever until brakes are set. Check the corresponding circuit breaker {60.1} inside the LVC for unexpected tripping (behind right door)

Figure C-4: Electrical Locomotive Parking Brake drive unit LPB

– Release hand brake by pushing the button RELEASE on the electrical Locomotive Parking Brake drive unit LPB.

- Check indicator LED
- The green LED light stays lit for 5 seconds once the brake is released.

In case the battery voltage is not sufficient to enable motor driven application of the hand brake the personnel has to pull the manual release lever one time. Check the corresponding circuit breaker {60.1} inside the LVC for unexpected tripping (behind right door).

7.2.12 Change Operation Cab

– Repeat brake tests in the other cab.

7.3 Operating the Pantographs

During normal operating conditions, the isolation switches to both pantographs are closed. The trailing pantograph is raised and receiving current. Current passes through the closed isolation switch {2.4} and on to the main circuit breaker {5} (both located in the HVC). The leading pantograph is in the down position (see "Raising the pantographs" on page 225.)

Mortal Danger!

To avoid serious injury, do not open any of the cubicle doors in the machine room unless all of the following conditions are met:

- A visual check has been made to confirm that both pantographs are down.
- All concerned personnel know that both pantographs are down.
- One pantograph switch is in the DOWN position.
- The pantograph grounding switches and lock down claws must be engaged for both pantographs.

Note!

The pantograph valve with the blue key switch is located on the CMP in the machine room. This key-operated valve may be used to disengage the pantograph in case of emergency.

Note!

If both pantographs are up and connected when entering a phase break, the MCB will open and both pantographs will drop.
In addition, be sure to follow all NJTransit operating rules when working with pantographs and other high voltage equipment.

7.3.1 Lowering the Pantographs

- From either cab, move the Pantograph Switch {129} (on CDPM) to the DOWN position.
- From the ground, visually inspect the pantographs from outside the locomotive to confirm that both of them are down. Observe all safety precautions.

Mortal Danger!

Do not operate Pantograph Isolation Switch {129.3} on the CRWPF unless both pantographs are lowered. Moving either isolation switch in the HVC with either pantograph raised will damage the high voltage switch gear.

7.3.2 Scraping freezing rain from the catenary

During freezing rain scraping operations, the trailing pantograph is raised and collects current. The lead pantograph, isolated by setting the Pantograph Isolation Switch {129.3} on CRWPF to the corresponding position, is raised to scrape freezing rain from the catenary.

To prepare for freezing rain scraping:

- Check that both pantographs are lowered and that the pantograph grounding switch and lock down claws are disengaged for both pantographs.
- Determine which end of the locomotive will have the leading pantograph.
- Following the NJTransit safety rules, set the Pantograph Isolation Switch on CRWPF to isolate the leading pantograph.
- Prepare to raise both pantographs by setting the Pantograph Selection Switch on CRWPF to BOTH.
- Be sure the Pantograph Switches {129} in both cabs are in the NORMAL position (or in UP position in old locomotives when in MU operation). (Leaving either switch in the DOWN position disables the PAN UP command).
- Momentarily set the Pantograph Switch {129} (on CDPM) to the UP position and listen for the raising pantograph.
- From the ground, visually check that both pantographs have engaged the catenary.
- Operate the vehicle following NJTransit operating rules.
- When freezing rain scraping is finished, reconfigure the pantographs while following the NJTransit safety rules.

Warning!

Do not reset the Pantograph Selection Switch or attempt any other shortcut to lower the

isolated leading pantograph. Follow all steps to reconfigure the pantographs for normal operation.

7.3.3 Changing operating ends

To change operated cabs, deactivate the currently operated cab, then inspect and set up the currently non-operated cab.

See "Setting up the non-operated cab" on page 227 and "Setting up the operated cab" on page 227 for procedures.

Re-configuring the Pantographs:

To reconfigure the pantographs when changing operating ends

- Move the Pantograph Selection Switch to either F or B, depending on which will be the trailing pantograph. The leading pantograph will lower after 10 seconds.
- Operate the locomotive while following NJTransit operating rules.

7.4 Checks before moving the locomotive

- View the duplex air gauges in the cab to be sure that main reservoir air pressure is between 130 and 140 psi.
- Check that the brakes are applied by inspecting the brake applied indicators (on the outside of the locomotive) for both trucks (the red window should be displayed).
- Press the OUT button on the cab control portion. Then use the independent brake to check for proper release and application of locomotive brakes (check the BC gauge). Check that the brakes are properly applied and released by inspecting the brake applied indicators.
- Check each side of the locomotive for

chocks, chains, or other obstructions, removing them as necessary.

- Once all obstruction have been removed, release hand brake.
- Move the reverser to F, N or R and press the cab control portion IN button to cut-in the brake.
- Press and hold the Indication Light Toggle Switch {324.5} (on CSP2) to TEST. While pressing the toggle switch, check that the indicator lamps on panel CSP3 come on.

7.5 Driving

For information on the controls and indicators see “Controls and Indicators” on page 55.

For information on the Intelligent Display Unit (IDU) and the buttons (hardkeys and softkeys) see “Using the intelligent display unit (IDU)” on page 175.

Note!

If a fault occurs, this is shown on the IDU (screen).

Correct the fault by following the instructions on the screen.
Switch back to the main menu after correcting the fault. The fault signal fields should now be cleared.

7.5.1 Starting and accelerating the locomotive

Note!

The maximum speed of the locomotive is 100 mph.

Note!

To re-apply tractive effort, the controller must first be put in the “0” position.

Procedure/checking

- Secure the train against unintentional movement.
- Enter the train data on the IDU.
- Secure the train with the independent or automatic brake.
- Release the hand brake in the machine room.

- Put the reverser on the engineer's desk in the required direction of movement "F" or "R".
- Move the automatic brake valve on the engineer's desk to the "Release" position.
- Move the independent brake valve to the "Release" position.
- Turn on headlights and bell as required.
- Check that the Door Closed light(s) (on CSP3) is ON.
- Slowly move the throttle handle away from the 0 position until the desired locomotive speed is attained.
- Sanding is provided automatically depending on track conditions. It is controlled by the traction control electronics. The engineer can also select sanding manually by operating the non-latching toggle switch Sand {192.1} on the CDPM.

Note!

Sanding proceeds as long as the toggle switch is pressed or for the length of time requested by the vehicle control!

Mortal Danger!

The independent brake for the locomotive must be applied whenever the train is stopped.

Mortal Danger!

Don't leave the cab while a driving direction is selected.

7.5.2 Starting on ascending grades

– With the train at a complete stop, fully apply the independent brake and then check that the automatic brake handle is set to the RELEASE position.

Note!

Do not release the automatic brake if passengers are being loaded. Wait until they are all aboard.

– After the automatic brake has fully released, advance the throttle while gradually releasing the Independent brake.

Note!

Propulsion power is removed after 21 seconds (as indicated by a zero TE meter reading). In addition, the NO POWER BRAKE Light (on CSP3) comes on if the independent brakes are not fully released within 21 seconds after applying the throttle or not fully released when the speed has exceeded 5 mph. If the NO POWER BRAKE Light is on, power to the traction motors is cut off.

– If the NO POWER / BRAKE light comes on (see "Responding to the No Power / Brake light" on page 248.), restore propulsion power by fully releasing the air brakes, returning the throttle to "O" and then gently reapplying the throttle.

Safety Considerations:

To prevent rollback when starting on a steep grade, you may need to apply power while the independent brakes are set.

The Vehicle Control permits the application of power for 21 seconds with train speed below 5 mph and the independent brakes applied.

When you must stop the locomotive on a steep ascending grade, you may apply sand during the last 50 feet to maximize adhesion for starting.

7.5.3 Responding to the No Power / Brake light

There is no power during a NO POWER / BRAKE condition. To resume power operation:

- Return throttle to the 0 position.
- If desired, advance the throttle.

The NO POWER / BRAKE indicating light comes on when:

- Independent or automatic brakes are applied to 20 psi BC or more, and
- throttle is in any position from P1 through F.

When the indicating light comes on, propulsion power is cut off automatically. If you release the brakes but leave the throttle in power positions P1 through F, the NO POWER / BRAKE indicator remains on and power remains off.

The NO POWER / BRAKE indicator goes off when you return the throttle to the 0 position. You may continue operation by advancing the throttle.

If the NO POWER / BRAKE indicator lights while operating below 5 mph, return the throttle to the 0 position to draw power 21 seconds while releasing the brakes.

If the NO POWER / BRAKE indicator lights a second time while operating under 5 mph, return the throttle to the 0 position or release the air brakes to regain propulsion power.

The NO POWER / BRAKE indicator also lights immediately if brakes are applied at speeds above 5 mph, and the throttle is in propulsion.

7.5.4 Handling phase breaks

The Vehicle Control system automatically re-configures the locomotive as it enters sections with different catenary voltage and frequency. In case of incorrect re-configuration, the main circuit breaker will not close and fault information will be shown on the IDU.

If for some reason the re-configuration command needs to be given manually to the Vehicle Control, press the push button VC/PB Manual {247.5} (on CDPM) and lower the pantograph when operating from the cab control car.

7.5.5 Responding to the power control switch

The Vehicle Control resets the system following a penalty or emergency brake application. The PCS indicator lamp {168.6} (on CSP3) will be lit.

Resetting After a Penalty Brake Application

- Move the throttle to the 0 position.
- Move the automatic brake handle to the LAP position and hold for a minimum of eight seconds to reset the penalty brake condition.
- After the PCS lamp goes out, release the brakes.

To prevent another penalty brake application:

- Reset the alerter when the locomotive brakes are released.
- Be sure to acknowledge a more restrictive cab signal aspect.
- Temporarily suppress air brakes within 4 seconds and permanently suppress the air brakes within an additional 4 seconds if:
  - Locomotive is exceeding cab signal aspect speed.
  - Locomotive speed exceeds 79 mph

when the TERRITORY switch on the ADU panel is in the NON-CODED position.

Resetting After an Emergency Brake Application

- Move the throttle to the 0 position.
- Move the automatic brake handle to the EMERGENCY position.
  - Allow at least 30 seconds for the brake system to reset.
- Move the automatic brake handle slowly to the RELEASE position.
- Make sure that the PCS lamp goes out.

7.6 Braking

7.6.1 Automatic brake

The automatic brake is operated by the EPIC II system. The automatic brake is controlled by the automatic handle of the cab control portion of the EPIC II system located in each cab. The cab control portion allows you to select basic operation modes of the automatic brake:

- LEAD/CUT IN (indicator lamp IN).
- LEAD/CUT OUT (indicator lamp OUT).
- TRAIL (indicator lamp TRAIL).

In mode LEAD/CUT IN the brake pipe pressure is controlled by means of the automatic brake handle located on the cab control portion to perform service brake, maintain the brake level, brake release and trigger the emergency brake.

7.6.2 Independent brake

The independent brake is operated by the EPIC II system. Brake application is performed by means of the cab control portion located in each cab. When the brake is applied, the brake cylinder pressure is visible to the engineer by means of the air gauge (manometer) and signalled to the control system through the serial link.

7.6.3 Hand brake

The hand brake on the ALP-46 consists of an electrical Locomotive Parking Brake drive unit LPB which is normally actuated by pushing the push buttons.

In case the battery voltage is not sufficient to enable motor driven application of the hand brake the personnel has to stroke or pull the manual set resp. release lever until brakes are set resp. released.

The state of the hand brakes of the coaches and other locomotives is read from the trainline.

The Vehicle Control does not know where the hand brake was applied in the train consist (ALP-46 or other locomotive or coach).

If the ALP-46 hand brake is applied, the outside lamps and the trainline signal are automatically activated by hardware.

If the trainline signal is active, the Vehicle Control Unit will:

- light up the hand brake indicator lamp for the activated cab.
- will not impose a traction interlock (either in motion or when the train is stopped).
- generate an IDU information Message when the train is in motion ("hand brake applied").

EDITION C: 2003. SEP. 15

7.7 General system shut-down

- Apply brakes and ensure that the train is motionless.
- Set the controller to the zero position.
  - The pulsing of the traction converter will stop after 5 s (only if vehicle is motionless).
- Move the reverser to Neutral (N).
  - Deselect driving direction.
- Apply the hand brake.
  - Vehicle Control not involved (feedback signal for monitoring purposes).
- Put the Pantograph Selection Switch {129.2} to the "down" position.
  - Open the MCB.
  - Lower the pantograph.
  - Shutdown of the traction converters DC-link is discharged.
- Set all switches and push buttons to their default position.
- Move the reverser to Isolated (I) and remove the handle.
  - Deactivate cab.
- Turn the Battery Contactor Switch {125} to the OFF position.
  - Vehicle Control System self hold is effective.
  - Vehicle Control System shuts down and switches itself off.
- Close the auxiliary reservoir cut out cock [29/2] on the auxiliary panel in CMP.

7.8 HEP system configuration

Following steps must be made to set up the HEP system.

Check that all possible power sources for the HEP trainline of the train consist are de-energized:

- this locomotive
- other locomotives coupled to this locomotive or to the train consist
- wayside power / shop power

Plug in the four HEP Car Jumper Cables {35.1} into the HEP Trainline Receptacles {35.11 to 35.14} at the F-end and B-end as required by the position of this locomotive within the train consist.

Turn the operation mode selector switch Switchover Wayside Power / HEP TL {42.6} located on Switch Panel ASD to select one of the four HEP modes:

1. DEAD – enables the feed to the dead locomotive to charge the battery through the HEP trainline backwards via contactor {52.6}
2. OFF/WAYSIDE – the HEP trainline supply is OFF, enables the feed to the locomotive via Wayside Power Receptacle {42.1} and contactor {52.3}
3. HEP ON – enables to supply the HEP trainline via contactor {32}; all of the fixed frequency loads on the locomotive are fed by the HEP transformer
4. OFF/THRU – disables the HEP trainline supply in multiple traction, enables the 480V HEP power fed by another source to pass through this locomotive, but fixed frequency loads on this locomotive are fed by the HEP transformer.

Set up the HEP Receptacle Isolators {32.9} in correspondence to the configuration of the coupled train consist.

The HEP Isolator Selector Switch F-End

{169.21} and the HEP Isolator Selector Switch B-End {169.22} (both are located on the Switch Panel ASD) must be turned to the ON or OFF position, depending on the position of the locomotive within the train consist and/or the HEP trainline connection cables.

Check the correct connection of all the HEP Car Jumper Cables and HEP Loop Jumper Cables plugged into the locomotive and cars.

The engineer must then push the button HEP Trainline Complete {32.12}, located on the Switch Panel ASD. A correct connection will be indicated by two indicator lamps located beside the push button.

The indicator lamp HEP TL Right Compl. {82.1} shows the correct connection of the checked cables on the right side of the train consist. The indicator lamp HEP TL Left Compl. {82.2} shows the correct connection of the checked cables on the left side of the train consist. The HEP trainline cable connections are only correct and ready for operation if both of the indicator lamps light up and keep on lighting. Otherwise the HEP Main Contactor {32} will be interlocked by the MITRAC system and the locomotive will not be enabled to supply the HEP trainline.

The HEP Main Contactor {32} has to be enabled to close by turning one of the HEP TL Release Switches {32.11} to the ON position. These switches are located in Cab F and in Cab B on the Cab Rear Wall Panel (CRWP).

When the HEP Main Contactor {32} is closed, the signal lamp Indication HEP Main Contactor Closed {169.3} on the Cab Side Wall Panel (SWP3) will light up. The signal lamp Indication HEP Main Contactor Open {168.3} on the Cab Side Wall Panel (SWP3) will go out. The HEP trainline is now supplied with 480V power.

If the Engineer intends to de-energize the HEP trainline, then one of the HEP TL Release Switches {32.11} must be turned to the OFF position. The HEP Main Contactor {32} will open and this state will be indicated by the signal lamp

Indication HEP Main Contactor Open {168.3} lighting up. The signal lamp Indication HEP Main Contactor Closed {169.3} will go out. The HEP trainline is now disconnected from the 480V power.

8 Automatic Brake Application and Traction Cut-Out

8.1 Automatic brake application caused by the alerter

The purpose of the alerter is to stop the train by means of the penalty brake when the presence or alertness of the engineer is in question.

The alerter function is handled by the VCU and the penalty brake application is carried out by the EPIC II.

The alerter is also active in simulation mode.

The alerter can be cut out in the following way:

- Alerter Cutout Switch {237.1}.

The engineer is informed of a cut out alerter via a priority 2 IDU fault report

- upon activation of the Alerter Cutout Switch {237.1}
- each time the cab is activated on the vehicle where the alerter is cut out

The following conditions and engineer manipulations (edge driven, both edges accepted) reset the alerter function:

- an ATC acknowledge (ATC output (PB ATC acknowledge OR foot pedal))
- pressing Foot Pedal Horn
- pressing Push button Bell
- pressing Push button Alerter Acknowledge
- throttle movement which changes the status of the trainline {TL 15T AV} to traction mode
- throttle movement with the same sensitivity in dynamic braking operation.
- EP brake applied (EPIC relay #20)

8.2 Automatic brake application caused by break of train

If the train breaks, the brake pipe hoses are separated which causes the main reservoir pressure on the locomotive to drop rapidly. When the pressure drops below 3.0 bar, the pressure monitor initiates a traction interlock, emergency braking and a corresponding alarm on the display.

8.3 Automatic brake application caused by low battery voltage

If the battery voltage drops below 57 V, a fault alarm is shown on the display.

The vehicle control electronics is switched off if the battery voltage drops below 55 V. However, the brake control electronics remains active.

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In both cases the train must be brought to a halt immediately.

8.4 ATC Penalty Brakes

The ATC is activated. In Rollaway protection mode, it will restrict the train rolling distance by applying a full service brake.

In case of train overspeed, the speed exceeds 105 mph (170 km/h), a penalty brake is requested until standstill.

EDITION C: 2003. SEP. 15

9 Operating Conditions

9.1 Normal operating condition

9.1.1 Leading mode

The vehicle is in leading mode when,

- any cab in the vehicle is activated and reverser is not in the Isolated (I) position

9.1.2 Trailing mode

The vehicle is in trailing mode when:

- the reverser in both cabs is in the Isolated (I) position

In trailing mode, the activated vehicle is either:

- the Cab Control Car, or
- another locomotive is in leading mode

It is also possible that no vehicle within the train consist is in leading mode.

The trailing vehicle receives its commands via the trainline. A lot of functionality is handled at vehicle control level due to the restrictions in the amount of information transferred via the trainline.

9.1.3 Towing mode

Towing mode is necessary when:

- the locomotive is being transported
- no primary voltage is available
- the Vehicle Control has a serious fault

The brake control electronics is active in towing mode.

In towing mode, at least the main brake pipe must be connected to allow braking. The Vehicle Control is switched off in towing mode.

9.1.4 Cab control only mode

The Vehicle Control is in Cab Control Only mode when the traction on the locomotive is isolated.

The train level Vehicle Control functionality is fully available.

Traction is only possible if another locomotive is present in the train consist. The auxiliary power supply is only available if it is provided through the HEP trainline by another locomotive. Battery charging is only possible in this case.

9.2 Shunting (coupling the locomotive to the train)

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Always operate the HEP TL Release Switch {32.11} (on CRWPF or CRWPB) to OFF or set the HEP Isolator Selector Switch {169.21} or {169.22} (on ASD) to OFF before coupling or uncoupling from cars or changing the makeup of the train.

- Couple to cars.
- Stretch couplings to ensure couplers are locked.
- Move independent brake handle to the fully applied position.
- Couple main reservoir and brake pipe hoses to cars.
- Open the main reservoir cut out cock slowly, then open the brake pipe angle cock slowly.
- Connect both 27-pin control receptacles (for communications and for traction) and the four (4) HEP jumper cables.
- If the HEP selector switch {42.6} (on the ASD) is set to ON, check that the Trainline Complete left side and right side indicator lamps go on. The TLC indicators are located on the Indication Light Panel

(CSP3) and the Switch Panel ASD.

Observing the rules:

Observe NJTransit operating rules, special instructions, air brake rules, and safety instructions concerning the following systems:

- Automatic Air Brakes.
- Fire Extinguishers.
- Cab Signal / Automatic Train Control.

9.3 Preparing for double heading

- Observe NJTransit operating rules and precautions before moving the locomotive.
- Couple the units together.
- Stretch the coupling to ensure that couplers are locked.
- Make sure
  - HEP is off.
  - Throttles are in 0 position.
  - reverser is in Isolate (I) position.
  - Brakes are applied.
- Connect the brake pipe and main reservoir ("CAR SUPPLY") air hoses. Also connect the main reservoir, actuating, and independent application and release hoses between units, then slowly open angle cocks and cut out cocks.
- Connect both 27-pin control receptacles (for communications and for traction) and the four (4) HEP jumper cables between the units.
- Make round, roof, equipment room, and non-operated cab inspections on the added unit.
- Select desired pantograph on each unit individually and raise the pantograph(s).
- Prepare the lead unit for double heading the same way you prepare a single or controlling unit of a consist (see “Setting

up the operated cab" on page 227).

Note!

Ensure that the non-operated cab is set in a similar fashion.

On the trailing unit:

- Move the Automatic brake handle to the HANDLE OFF position.
- Move the Independent brake handle to the RELEASE position.
- When ER and BP gauges both indicate 0, move the reverser to Isolated (I).
- Check that the OUT indication is lit.
- Press the TRAIL button and check that the TRAIL indication is lit.
- Make sure that the air brake controls in the other cab also are set for a non-operated cab.
- Make sure that the brakes are controlled by the lead unit.
- Make sure that the throttle operation is normal.
- Make sure that the EP Brake switch is set to OFF.

9.4 Handling a dead locomotive in the train (dead in tow)

Alternative A, only brake pipe hose connected

- Drain all air from both main reservoir tanks.
- Open the Battery Contactor Switch {125} (on CRWPF).
- Open circuit breakers for ATC {240.1}, Brake Controller {260.8} and Radio {351.11} and {351.12} (all on LVC).
  - The Battery Disconnecting Switch {113} (inside the LVC) should not be opened!

EDITION C: 2003. SEP. 15

- Place the independent brake handle to RELEASE.
- Place automatic brake handle in HANDLE OFF position (HO).
- Open dead engine feature cut-out cock (on CMP), to IN position.
  - Main reservoir pressure will charge to approximately the same pressure as the brake cylinder.
- Be sure pantographs are locked down and grounding switches are closed.

Alternative B, brake pipe and main reservoir hoses connected

- Open the Battery Contactor Switch {125} (on CRWPF).
- Open circuit breakers for ATC {240.1}, Brake Controller {260.8} and Radio {351.11} and {351.12} (all on LVC).
  - The Battery Disconnecting Switch {113} (inside the LVC) should not be opened!
- Place the independent brake handle to RELEASE.
- Place automatic brake handle in HANDLE OFF position (HO).

9.5 Operating through water

Do not run the locomotive through water that is more than 3 inches above the rail or touches any traction motor.

Never exceed 2 mph when operating with water over the rails.

10 Leaving the locomotive

10.1 Normal case: Leaving the locomotive including checks

Carry out the following steps in the prescribed order!

Inform the service department if you find heavy wear or damage.

Work in Cab F - Part I

- Switch off the train radio equipment
- Release the independent brake until the BC gauge indicates 0.5 bar
- Briefly operate the sander for both directions of travel
- Move the pantograph selection switch to the "BOTH" position

Work outside of the locomotive

- Take along a flashlight if necessary
- Carry out the following checks on the trucks as far as it is possible without moving the locomotive:
  - Visual check of the wheel tires: check profile and running surface for heavy wear (e.g. cracks, chips, flat spots)
  - Visual check of wheel flanges for damage and burrs
  - Visual check of wheel axle bearings
  - Visual check of dampers
  - Visual check for other obvious damage
  - Manual check to make sure that auxiliary components are securely attached
- Check correct function of the sanders and check if there is enough sand.
- Check the correct position and state of the speed sensors, earthing contacts and connecting cables
- Visual check of the pantographs

Work in Cab F - Part II

- Lower the pantographs
- Move the reverser to Isolated (I)
- Check whether all switches are in the normal position

Work in the machine room

- Check the oil level in the compressor
- Check the coolant level in traction converters 1 and 2
- Check the coolant level in the transformer

Work in Cab B

- Close all windows and doors
- Move all switches to the normal position
- Switch off the cab lights

Work in Cab F

- Switch off the machine room lights.
- Turn the Battery Contactor Switch {125} to the OFF position. The battery will be disconnected from the main loads after an orderly shutdown of the control electronics and opening of the Main Battery Contactor {126.4}. The essential loads will remain energized for 60 minutes from the time when the Main Battery Contactor {126.4} is opened.
- Switch off the cab lights
- Close all windows and doors
- Put away timetable documentation

11 Special Events in Operation

11.1 Towing the locomotive

The towing mode is necessary when:

- the locomotive is being transported
- no primary voltage is available
- the loco has a serious fault

The brake computer is active in towing mode.

In towing mode, at least the main brake pipe is connected to allow braking.

The Vehicle Control is switched off in towing mode.

11.2 Coupling/uncoupling

When coupling or uncoupling an ALP-46, all ALP-46 locomotives must be switched off because the trainlines are powered by all ALP-46 locomotives, see "Shunting (coupling the locomotive to the train)" on page 260.

When coupling or uncoupling an ALP-46, the HEP supply must also be switched off. This is also a reason why the HEP supply is automatically switched off by the Vehicle Control whenever the train is motionless and the trainline is incomplete.

11.3 Alerter out of order

Mortal Danger!

If the alerter (deadman device) becomes faulty, after de-activating the alerter function you are permitted to drive the locomotive to the next repair facility (terminal). Refer to the relevant regulations (49 CFR 238.237) for more information.

EDITION C: 2003. SEP. 15

11.4 Low battery voltage

If the locomotive is shut down for a longer period, the train staff must open the Battery Disconnecting Switch {113} (inside the LVC) to cut off all loads from the battery. Otherwise the loads which are not automatically cut off will drain the battery.

Battery low voltage protection:

If the battery voltage is

- lower than 61 V for 30 seconds an IDU fault report is generated to draw the Engineer's attention to the dropping battery level.

Monitoring with MCB Closed:

The MCB can be closed, if the battery voltage is higher than 55 V. If the MCB is closed for longer than 180 seconds and the battery voltage is lower than 57 V for longer than 30 seconds, the vehicle is not able to charge the battery itself and Vehicle Control will open the MCB and isolate the main supply. If the loco has been standing for half an hour and no cab is activated, the Control Electronics are switched off.

Switching on the Loco:

The Control Electronic switch off threshold (55 V) is lower upon switching on the Control Electronics than during service. The reason for this is to switch off before the battery is empty, but allow a loco make up with a low battery to be able to recharge the battery again. If the MCB is closed, the thresholds "Monitoring with MCB Closed" will apply, otherwise the threshold is switched over after 300 seconds to preserve the battery from unnecessary discharge.

Exception: The Vehicle Control System will not switch itself off automatically while the train is in motion.

A priority 1 IDU fault report will announce the approaching shutdown to the engineer.

To avoid surprising the engineer, an extra battery

low warning threshold is defined which is displayed to the engineer via the priority 2 IDU fault report.

If the battery voltage exceeds 80 V for 30 seconds, a priority 2 fault report will be generated. The engineer is not informed.

Whenever the battery is not being charged, a fault indication countdown is initiated. The main reason for this countdown is to prevent an unnecessary battery discharge when the train is not attended. For this reason, the following levels are defined:

- if the countdown reaches the equivalent of 30 minutes, a priority 2 IDU fault report is generated to inform the engineer.
- if the countdown reaches the equivalent of 45 minutes, a continuous alarm will sound {Buzz Alarm}
- if the countdown reaches the equivalent of 60 minutes, the Vehicle Control System will shut down and disconnect itself from the battery.

If the Vehicle Control System is powered up again, the countdown process starts again.

The countdown is frozen when the "Battery charger on" signal is active.

The alarm bell does not ring while the countdown is frozen.

The countdown is reset:

- when the battery voltage is above 70 V for longer than 10 minutes.
- when the train speed is above 5 mph
- when the throttle is moved.

By operating the throttle or moving the train, the engineer assumes responsibility for battery charge and resets the automatic shutdown.

The countdown is not active when the vehicle is in simulation mode.

Note!

The battery and the battery cables are protected by Battery Fuses {112}. If one of the fuses opens and the battery charger is not active, the vehicle control will shut down immediately. No orderly shutdown will be possible.

If the battery charger is active when one of the fuses opens:

- A priority 2 fault will be reported on the IDU.
- The alarm bell will ring.
- The engineer must decide how to proceed further (If the MCB opens in case of phase breaks, the vehicle control will shutdown immediately).

Battery cell check: 5 seconds after the battery charger has stopped charging the battery (e.g. phase break or MCB off), the actual battery voltage is checked by the Vehicle Control System.

12 Help in case of faults

12.1 Indication of faulty operation during start up

An IDU information message is issued if an operation cannot be performed because the sequence control is not in the right state for this operation or the engineer does something wrong.

The following information messages are provided:

IDU information messages concerning pantographs:

- Not possible to raise PG. Cab not activated
- Not possible to raise PG. Pantograph down signal active

IDU information messages concerning the MCB:

- Not possible to close MCB. Primary voltage out of range.

IDU information messages concerning Traction or Braking effort (TE/BE):

- TE/BE not possible. Traction Converter not set up
  - Move the throttle to the zero position to cancel traction interlock

EDITION C: 2003. SEP. 15

12.2 Checking the Buchholz protection

A two-level Buchholz gas protection {210.7} monitors the transformer for faults such as short circuits or leakage.

- Level 1 (warning): a priority 2 IDU fault report is generated. The engineer is told in the instruction text to check the transformer coolant circuit for leakage, and to open the circuit breakers CB Trafo Coolant Pump, {62.1/1} and CB Trafo Coolant Pump, {62.1/2} when necessary to protect the environment. If the circuit breakers are opened, the MCB is opened and re-closure is inhibited as long as both circuit breakers are open.
- Level 2 (fault): a priority 1 fault report is generated and the main supply is isolated. Upon isolation of the main supply, a priority 2 IDU fault report is generated to inform the engineer of the isolation.

12.3 Enabling traction power

Traction power can only be enabled if:

- the trainline signal {TL 16T ER} engine run is active,
- the trainline signal {TL 06T GF} is active, and
- the Propulsion Isolation Switch {156} is not active (this switch only applies to the local vehicle).

If {TL 06T GF} is active before {TL 16T ER} a traction interlock is triggered to prevent unexpected application of traction effort upon closing the train doors.

The leading vehicle activates {TL 16T ER} if the following conditions are fulfilled:

- no penalty or emergency brake active AND
- the trainlines indicate closed doors.

The leading vehicle activates {TL 06T GF} when the {Throttle} is moved into a traction position.

The leading vehicle resets the trainline signal {TL 06T GF} straight away when the {Throttle} is in the zero position.

The pulsing of the traction converter is a vehicle control level function. Each vehicle generates the pulse and pulse lock command itself.

The pulsing of the traction converter is **activated** under the following conditions:

- if the traction power is enabled AND
- if the Vehicle Control is ready to activate the pulsing of the traction converter AND
- if a driving direction is selected AND
- (leading vehicle): if the traction controller handle {Throttle} is moved out of the zero position
- (trailing vehicle): if the trainline signal {TL 06T GF} is activated

The pulsing of the traction converter is **disabled** under the following conditions:

- if a pulse interlock (vehicle level) is active OR
- if the emergency brake is applied OR
- (leading vehicle): if the {Throttle} is in zero position for 5 s and train motionless
- (trailing vehicle): if trainline signal {TL 06T GF} is not active for 5 s and the train is motionless

If traction effort is requested from the throttle or the train is in motion and the door control function has not enabled traction power, a traction interlock will be triggered by the Vehicle Control and displayed as an IDU information message to the engineer.

13 What to do in case of FIRE

Mortal Danger!

Stay calm. Think before you act. Avoid panic.

Mortal Danger!

Breathing poisonous vapors caused by fires can damage the health. The engineer must use a gas mask and breathing equipment during fire fighting.

- Request help.
- Press the emergency stop button.

Mortal Danger!

Don't stop the train on bridges and tunnels or at places which are hard to access.

In case of fire, the engineer must proceed according to the NJTransit Operating Rules

- Press the emergency stop button to bring the train to a standstill.
- Report the fire. Specify the cause of the fire, the extent and the exact position of the locomotive.
- Remove the fire extinguisher from the holder and prepare it for use.
- Fight the fire if possible.
- If the fire gets out of control, leave the loco and wait in a safe distance away for the fire department to arrive.

EDITION C: 2003. SEP. 15

Index

EDITION C: 2003. SEP. 15